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THE PYCNOGONIDA OF THE WESTERN NORTH ATLANTIC AND THE CARIBBEAN

BY

JOEL W. HEDGPETH

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By Joel W. Hedgpeth

Since Wilson's "Report on the Pycnogonida of New England and Adjacent Waters" (1880) and his "Report on the Pycnogonida of the *Blake*" (1881), there has been no comprehensive treatment of the pycnogonids of the eastern United States and the deeper waters of the western Atlantic.[1] The extensive dredging operations of the steamer *Albatross* from 1883 to 1887 off the eastern United States brought up a large assortment of pycnogonids, several of them undescribed at the time. These were laid aside by the late Prof. A. E. Verrill, who planned a report on them. This did not materialize, however, except for a preliminary list (1885) on the first season's work of the *Albatross*.

Taxonomic work on the group from western Atlantic waters since that time is represented by two short papers (Verrill, 1900; Cole, 1904b) on species from Bermuda, and one (Cole, 1906a) on a Bahama species. More recently, Giltay (1934d) described another species from Bermuda, but his plan to work up the United States National Museum collections from the Caribbean region was cut short by his untimely death.[2] The pycnogonids of the Woods Hole region are well known

[1] Edmund B. Wilson, 1856–1939, the great morphologist, embryologist, and teacher, noted for his treatise "The Cell in Development and Inheritance." His early work with the Pycnogonida has been recognized by Schimkewitsch (1887, 1889), who dedicated *Achelia wilsoni*, a species from southern Argentina and Chile, to him. See H. J. Muller: "Edmund B. Wilson—An Appreciation," Amer. Nat., vol. 77, pp. 5–37, 142–172, 1943.

[2] Dr. Louis Giltay, 1903–1937, ichthyologist and arachnologist. For an obituary, photograph, and bibliography, see V. van Straelen: "Louis Giltay, Notice biographique avec liste bibliographique." Bull. Mus. Roy. Hist. Nat. Belgique, vol. 14, No. 23, pp. 1–8, 1938.

as a result of the biological survey of that region by Sumner, Osburn, and Cole (1913), and the plankton studies by Fish (1925), but the long stretch of coast from Long Island to Key West and the Caribbean region have been inexplicably neglected.[3] This neglect was emphasized by Timmermann's (1932) study of the fauna of the sargassum in the mid-Atlantic, which demonstrated beyond question the pelagic occurrence of two common pycnogonids, *Anoplodactylus petiolatus* and *Endeis spinosa*. Because of our incomplete knowledge of Caribbean pycnogonids, Timmermann was unable to conclude whether these species originated from the European side of the Atlantic or the West Indian region.

Although contributing little to the zoogeography of pycnogonids, Cole's papers on the habits of *Anoplodactylus lentus* (1901, 1906b) and *Endeis spinosa* (1910) and Dawson's (1934) account of the corpuscles of the blood of *Anoplodactylus lentus* should be mentioned. Another important paper is T. H. Morgan's doctoral thesis on the embryology of Woods Hole pycnogonids (1891), which is a fundamental contribution to our knowledge of the subject.[4]

This review is based on the *Albatross* collections in the United States National Museum and the Peabody Museum of Yale University, comprising several hundred specimens; a large series of collections from the earlier dredgings of the Fish Commission in New England waters (including many of the lots cataloged in Wilson's reports), and more recent material in the National Museum from Chesapeake Bay to the northern coast of South America, including the collections from the Tortugas Laboratory of the Carnegie Institution of Washington by various collectors over a period of years: C. H. Edmondson, 1904; Leon J. Cole, 1905, 1906, 1908; Raymond C. Osburn, 1908; Waldo L. Schmitt, 1924, 1925, 1930, 1931, 1932; H. Boschma, 1925; C. R. Shoemaker, 1926. In addition to this material, the collections of the Museum of Comparative Zoology have been placed at my disposal, representing principally the Caribbean work of the *Blake* and the *Atlantis*. Some of this material has been discussed in a preliminary paper (Hedgpeth, 1943b).

For the privilege of examining the National Museum collections and for many other courtesies, I am indebted to Dr. Waldo L. Schmitt, head curator of zoology of that museum. I also wish to thank Dr.

[3] Wilson's *Blake* report discusses the dredgings made north of lat. 32° N. According to Hoek, in his concluding remarks in the *Challenger* Report (1881), the West Indian collections of the *Blake* were sent to Alphonse Milne-Edwards along with the Crustacea, and they may still be in the Paris Museum. The material now in the Museum of Comparative Zoology dredged by the *Blake* in the West Indies consists of seven species from eight stations (Hedgpeth, 1943b).

The Pycnogonida of the northeastern United States littoral are adequately represented in W. O. Crowder's manual "Between the Tides," pp. 334–339, figs. 319–326, 1931. The treatment is unusually complete for these obscure animals in a popular work.

[4] It is interesting to note that three eminent American zoologists, E. B. Wilson, Leon J. Cole, and T. H. Morgan, "cut their teeth" on studies of pycnogonids.

Stanley C. Ball, of the Peabody Museum, for the loan of the large collections from that museum, which include many valuable specimens listed in the literature, and Dr. Fenner A. Chace, Jr., formerly of the Museum of Comparative Zoology, for the loan of material and the time he took in my behalf while at Cambridge. The greater part of this study was carried out during the author's residence in California, 3,000 miles from the eastern museums, and required considerable correspondence and shipment of collections back and forth across the continent. This was an imposition on the time and patience of those who were kind enough to help me, and their generous cooperation has had no small part in making this report possible. Also I wish to thank John C. Armstrong, assistant curator of invertebrates in the American Museum of Natural History, for the loan of the pycnogonids in the collections of that museum. I am particularly indebted to Dr. Louis W. Hutchins for permission to make use of the collections made by the Woods Hole Oceanographic Institution fouling survey in advance of the comprehensive report on that collection in order that all the species found in the area of this report might be included in it.

CLASSIFICATION

The Pycnogonida constitute an independent class of the Arthropoda, with characters indicating affinities with both the Arachnida and Crustacea.[5] Their systematic position has been well summarized by Marcus (1940b, p. 129): "The Pantopoda do not in any phase possess the crustacean biramous limbs nor the arachnomorphous body composed of cephalothorax (prosoma) with six pairs of appendages and abdomen (opisthosoma). Therefore it seems advisable to consider them as a separate class of the Arthropoda—or the Euarthropoda, if the Malacopoda (Onychophora and Tardigrada) are left aside—and not to include them in the Crustacea or Arachnomorpha (Merostomata and Arachnoidea) and thereby make diagnoses for these classes impossible."

There are about 50 genera and 500 species of pycnogonids, but the group is so compact that many of the families are merely categories of convenience. Although attempts to divide the Pycnogonida into orders have been unsuccessful, there are two general groups. The first group, including the families Nymphonidae, Ammotheidae,

[5] Aside from considerations of personal sentiment and of priority (Pycnogonides Latreille, 1810; Podosomata Leach, 1815; Pantopoda Gerstaecker, 1863), the majority usage of Pycnogonida by English, Scandinavian, French, and American writers overrules the Pantopoda of the German, Russian, and other writers. Norman (1908) resurrected Leach's Podosomata because he did not believe that the name of a class should be derived from that of a genus included in it. Why not? (Cf. Bouvier's (1923, p. 3) passionate comments on the subject.)

In the recent revision of A. S. Pearse's "Zoological Names" (Duke Univ. Press, 1947) it would appear that I have sanctioned the retention of orders, since I am cited as the authority for the pycnogonid names in this brochure. I suspect the author was reluctant to adopt such a radical excision from his list.

Tanystylidae, and Colossendeidae, have ovigers in both sexes. Most of these families are also characterized by the presence of both chelifores and palpi in the adults, although the chelifores are reduced in the Tanystylidae and usually absent in adult Colossendeidae. The second group, comprising the Phoxichilidiidae, Endeidae, and Pycnogonidae, have ovigers only in the male and lack palpi, with the exception of rudimentary knoblike growths in some Phoxichilidiidae. Chelifores are also lacking in the Endeidae and Pycnogonidae. Midway between these groups is the family Pallenidae. Ovigers are present in both sexes in this family, chelifores are present and often well developed, but the palpi are greatly reduced or entirely lacking. In this family is included the genus *Pallenopsis*, which resembles the phoxichilidiid genus *Anoplodactylus* in the possession of tubular femoral cement glands in the male and in the structure of the cephalic segment. *Pallenopsis* has in fact been included in the Phoxichilidiidae by several writers, notably Calman and Gordon.

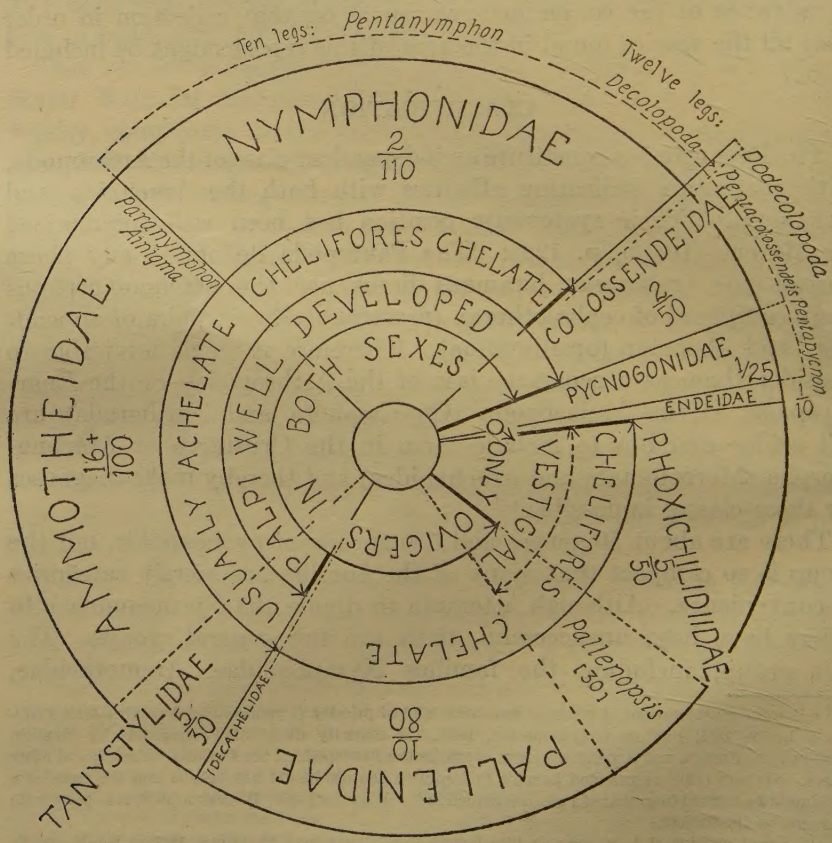

FIGURE 4.—Diagram of the families of Pycnogonida. The fractions indicate genera and species.

The relationships and comparative importance of the families have been discussed at greater length elsewhere (Hedgpeth, 1947). As can be seen from figure 4, which is in the nature of a quantitative as well as qualitative diagram of the families, I have reduced the number of families to eight:

1. Nymphonidae Wilson, 1878.
2. Pallenidae Wilson, 1878.
3. Phoxichilidiidae G. O. Sars, 1891.
4. Endeidae Norman, 1908.
5. Ammotheidae Dohrn, 1881.
6. Tanystylidae Schimkewitsch, 1913.
7. Colossendeidae Hoek, 1881.
8. Pycnogonidae Wilson, 1878.

Although the traditional order of the families in large reports has no particular correlation with the relationships of the families, it seems best to retain it as a matter of convenience.

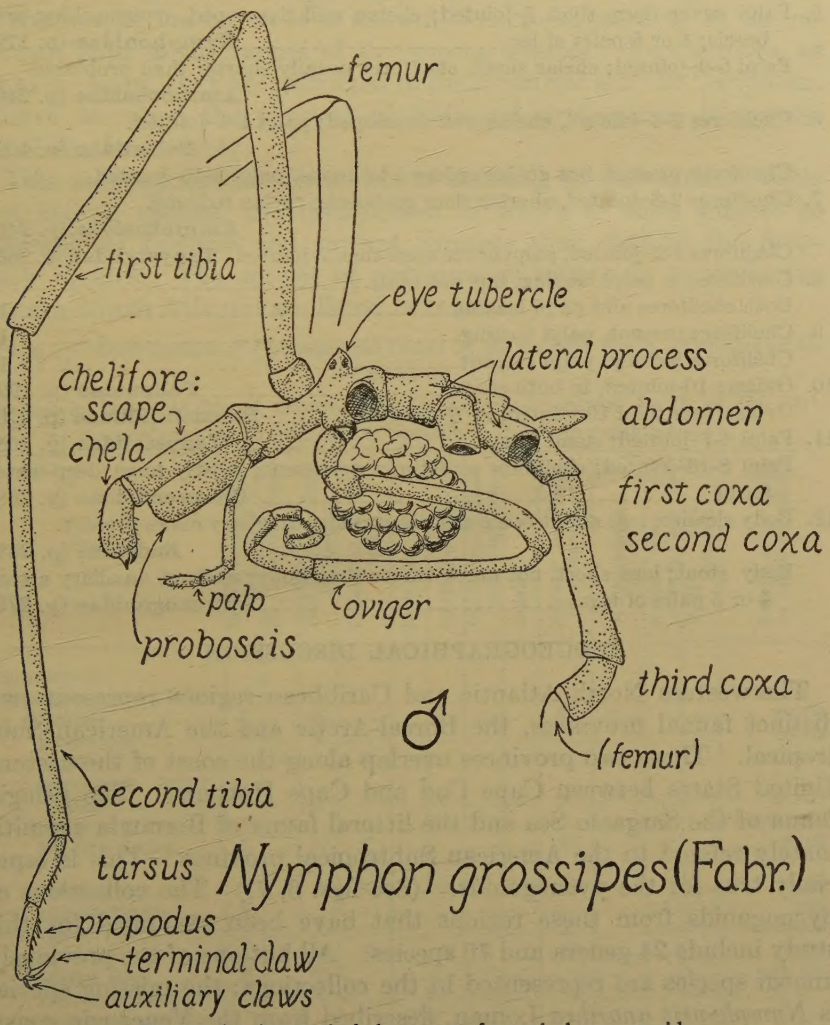

FIGURE 5.—Anatomical characters of a typical pycnogonid.

KEY TO THE FAMILIES OF PYCNOGONIDA

[MODIFIED FROM MARCUS, 1940B, PP. 15–16; SEE FIG. 5 FOR ANATOMICAL CHARACTERS]

1. Chelifores and palpi present 2
   Chelifores or palpi, or both, lacking or greatly reduced 8
2. Chelifores and palpi both well developed 3
   Chelifores or palpi, but not both, reduced 6
3. Palpi 17-20–jointed, first pair of legs with 12 or 13 secondary joints. **Ammotheidae** (*Nymphonella*)
   Palpi not more than 10-jointed; legs 8-jointed; usually with a terminal claw 4
4. Palpi 5-jointed, chelae well developed, *or* palpi 6-9–jointed, chelae small or rudimentary 5
   Palpi 9-10–jointed; 5 or 6 pairs of legs. **Colossendeidae** (Decolopoda, Dodecolopoda)
5. Palpi never more than 5–jointed; chelae well developed, overreaching proboscis; 4 or 5 pairs of legs ..... **Nymphonidae** (p. 179)
   Palpi 6-9–jointed; chelae small, chelifores usually shorter than proboscis. **Ammotheidae** (p. 240)
6. Chelifores 2-3–jointed, chelae well developed; palpi 1-4–jointed. **Pallenidae** (p. 199)
   Chelifores present, but chelae reduced to knobs, palpi 4-10–jointed 7
7. Chelifores 2-3–jointed, shorter than proboscis, chelae reduced. **Ammotheidae** (p. 240)
   Chelifores 1-2–jointed, palpi never more than 7-jointed. **Tanystylidae** (p. 266)
8. Chelifores or palpi lacking, but not both 9
   Both chelifores and palpi lacking 12
9. Chelifores present, palpi lacking 10
   Chelifores lacking, palpi present 11
10. Ovigers 10-jointed, in both sexes ..... **Pallenidae** (p. 199)
    Ovigers less than 10-jointed, in ♂ only ..... **Phoxichilidiidae** (p. 216)
11. Palpi 4-7–jointed; small forms ..... **Tanystylidae** (p. 266)
    Palpi 8-10–jointed; chelifores sometimes persistent; mostly huge deep-water forms ..... **Colossendeidae** (p. 268)
12. Body slender; legs about twice as long as body; auxiliary claws present. **Endeidae** (p. 238)
    Body stout; legs short, not much longer than body; without auxiliary claws; 4 or 5 pairs of legs ..... **Pycnogonidae** (p. 276)

ZOOGEOGRAPHICAL DISCUSSION

The western North Atlantic and Caribbean regions represent two distinct faunal provinces, the Boreal-Arctic and the American Subtropical. These two provinces overlap along the coast of the eastern United States between Cape Cod and Cape Hatteras. The pelagic fauna of the Sargasso Sea and the littoral fauna of Bermuda are ultimately related to the American Subtropical province. This is especially true for the pycnogonids. (See figs. 6, 7.) The collections of pycnogonids from these regions that have been examined for this study include 24 genera and 70 species. All but one of the previously known species are represented in the collections; the missing species is *Nymphopsis anarthra* Loman, described from the Venezuela coast.

The most interesting feature of the fauna of the western Tropical and Subtropical Atlantic is the occurrence of several small species, previously known from the eastern shores of that ocean. In the following discussion this distribution is attributed to the dispersing influence of ocean currents rather than to evolutionary convergence. Certainly the large number of closely related species in the Pycnogonida suggests a tendency toward divergence. On the other hand, the occurrence of decapodous species in widely separated families might be considered an example of convergence, although it is equally possible that it is simply the result of a basic similarity of chromosome pattern among the groups concerned. It may be significant that the distribution of these 10-legged pycnogonids appears to be localized or continuous insofar as it is known, i. e., there seem to be no important gaps in the ranges of the various species. Furthermore, as far as we know, they are restricted to the Antarctic and the Caribbean. I have discussed the problem of 10-legged pycnogonids in greater detail elsewhere (1947).

This zoogeographical discussion is confined to the shallow-water and littoral species, the distribution of which is more subject to geographical features and surface currents than that of the deep-water species. The species of pycnogonids known to occur in the western North Atlantic are listed in table 1.

TABLE 1.—*Distribution of Pycnogonida found in the western North Atlantic and the Caribbean*

[Species in brackets found occasionally in American waters south of lat. 60°. S=surface tow or sargassum records. P=deep pelagic tows]

Species	Boreal-Arctic America, South of 60°	N. Atlantic Basin (A: Azores)	New England, North of Cape Cod	Cape Cod to Hatteras	Bermuda	Hatteras to Bahamas	Caribbean (principally Tortugas)	Brazil	Norway to France (N.=Norway only)	Mediterranean	African coast, Morocco to Cape Verde	Pacific side of Isthmus	Bathymetric range in American waters
NYMPHONIDAE:													*Fathoms*
Nymphon spinosissimum (Norman)	X	----	X	------	----	----	----	----	X^N	------	----	----	190–471
hirtipes Bell	X	----	X	------	----	----	----	----	------	------	----	----	25–218
tenellum (Sars)	----	X	----	X	----	----	----	----	------	------	----	----	218–938
grossipes (O. Fabr.?) Krøyer	X	----	X	X	----	----	----	----	X	------	----	----	lit.–677
[*brevitarse* Krøyer	X	----	----	------	----	----	----	----	------	------	----	----	Sublittoral]
longitarse Krøyer	X	----	X	X (428f)	----	----	----	----	X^N	------	----	----	16–155
strömi Krøyer	X	----	X	X	----	X	----	----	X^N	------	----	----	7–524
[*elegans* Hansen	X	----	----	------	----	----	----	----	------	------	----	----	314]
rubrum Hodge	?	----	X	------	----	----	----	----	X	------	----	----	Sublittoral
macrum Wilson	X	X	X	X	----	X	X	----	X	------	----	----	35–843
[*sluiteri* Hoek	X	----	(?)	------	----	----	----	----	------	------	----	----	Abt. 100]
giltayi, new species	----	----	X	------	----	----	----	----	------	------	----	----	(?)
floridanum, new species	----	----	----	------	----	----	X^S	----	------	------	----	----	S–30

TABLE 1.—*Distribution of Pycnogonida found in the western North Atlantic and the Caribbean*—Continued

Species	Boreal-Arctic America, South of 60°	N. Atlantic Basin (A: Azores)	New England, North of Cape Cod	Cape Cod to Hatteras	Bermuda	Hatteras to Bahamas	Caribbean (principally Tortugas)	Brazil	Norway to France (N.=Norway only)	Mediterranean	African coast, Morocco to Cape Verde	Pacific side of Isthmus	Bathymetric range in American waters
PALLENIDAE:													
Callipallene brevirostris (Johnston)	----	----	(?)	X[S]	----	----	X	----	X	X	----	----	*Fathoms* S–28
phantoma (Dohrn)	----	A	----	----	----	----	S	----	X	X	----	----	S
emaciata (Dohrn)	----	----	----	----	----	----	S	----	----	X	----	----	S
acus (Meinert)	X	?	X	X	----	----	----	----	----	----	----	----	499–1,356
Pseudopallene circularis (Goodsir)	X	----	X	----	----	----	----	----	X[N]	----	----	----	Lit.–55
Cordylochele malleolata (Sars)	X	X	X	X	----	----	----	----	----	----	----	----	218–826
longicollis Sars	X	X	----	----	----	X	----	----	----	----	----	----	270–273
Pallenopsis forficifer Wilson	----	----	----	----	----	X	X	----	----	----	----	----	200–352
longirostris Wilson	X	(?)	----	X	----	X	----	----	----	----	----	----	79–841
calcanea Stephensen	P	P	----	----	----	----	----	----	----	----	----	----	500–1,000
schmitti Hedgpeth	----	----	----	----	----	----	X	----	----	----	----	----	20–155
Pigrogromitus timsanus Calman	----	----	----	----	----	X	----	----	----	Suez	----	----	Buoy, 3ft.
PHOXICHILIDIIDAE:													
Phoxichilidium femoratum (Rathke)	X	----	X	X	----	----	----	----	X	----	----	----	Lit.–55
Halosoma robustum (Dohrn)	----	----	----	----	----	----	X	X	----	X	----	----	Littoral
Anoplodactylus petiolatus (Krøyer)	----	S	----	----	----	X	----	X	X	X	----	----	S–43
parvus Giltay	----	----	----	X	X	----	----	----	----	----	----	----	12–45
pygmaeus (Hodge)	----	----	----	X	----	----	X	----	----	----	----	----	----------
lentus Wilson	----	----	----	X	----	X	X	----	----	----	----	----	Lit.–150
insignis (Hoek)	----	----	----	----	X	X	X	X	----	----	----	----	3–48
typhlops Sars	----	P	----	----	----	----	X	----	X[N]	----	----	----	582
? *maritimus* Hodgson	----	S	----	----	----	----	(?)	----	----	----	----	----	(?)
polignaci Bouvier	----	----	----	----	----	----	X	----	----	----	X	----	(?)
carvalhoi Marcus	----	----	----	----	----	----	X	X	----	----	----	----	Littoral
evelinae Marcus	----	----	----	----	----	----	X	X	----	----	----	----	Littoral
quadratispinosus Hedgpeth	----	----	----	----	----	----	X	----	----	----	----	----	(?)
stylirostris, new species	----	----	----	----	----	X	X	----	----	----	----	----	Littoral
pectinus, new species	----	----	----	----	----	----	X	----	----	----	----	----	3–10
sp. A (Tortugas)	----	----	----	----	----	----	X	----	----	----	----	----	10
sp. B (Florida)	----	----	----	----	----	----	X	----	----	----	----	----	45
ENDEIDAE:													
Endeis spinosa (Montagu)	----	S, A	----	X[S]	X	X	X[S]	X	X	X	X	----	S–38
AMMOTHEIDAE:													
Achelia spinosa (Stimpson) Wilson	----	----	X	X	----	----	----	----	----	----	----	----	Littoral
scabra Wilson	----	----	X	X	----	----	----	----	----	----	----	----	Lit.–45
gracilis Verrill	----	----	----	----	X	(?)	----	----	----	----	----	----	Littoral
sawayai Marcus	----	----	----	----	----	----	X	X	----	----	----	----	Lit.–25
brevichelifera, new species	----	----	----	X	----	----	----	----	----	----	----	----	410–428

TABLE 1.—*Distribution of Pycnogonida found in the western North Atlantic and the Caribbean*—Continued

Species	Boreal-Arctic America, South of 60°	N. Atlantic Basin (A: Azores)	New England, North of Cape Cod	Cape Cod to Hatteras	Bermuda	Hatteras to Bahamas	Caribbean (principally Tortugas)	Brazil	Norway to France (N.=Norway only)	Mediterranean	African coast, Morocco to Cape Verde	Pacific side of Isthmus	Bathymetric range in American waters
AMMOTHEIDAE—Continued:													
Ammothella rugulosa (Verrill)	----	----	----	------	X	----	X	X	------	------	----	----	*Fathoms* Littoral
marcusi, new species	----	----	----	------	----	----	X	----	------	------	----	----	Littoral
Nymphopsis anarthra Loman	----	----	----	------	----	----	X	----	------	------	----	----	20
duodorsospinosa Hilton	----	----	----	------	----	X	X	----	------	------	----	X	Lit.–10
Paranymphon spinosum Caullery	X	X	----	X	----	----	----	----	------	------	----	----	349–705
Ascorhynchus armatus (Wilson)	----	----	----	X	----	X	X	----	------	------	----	(?)	170–1,374
latipes (Cole)	----	----	----	------	----	X	X	----	------	------	----	----	200–352
colei Hedgpeth	----	----	----	------	----	----	X	----	------	------	----	----	70–80
serratum, new species	----	----	----	------	----	----	X	----	------	------	----	----	231
Eurycyde raphiaster Loman	----	----	----	------	----	X	X	----	------	------	X	----	Littoral
Ephyrogymna circularis Hedgpeth	----	----	----	------	----	----	X	----	------	------	----	----	565
Heterofragilia fimbriata Hedgpeth	----	----	----	------	----	----	X	----	------	------	----	----	476
Calypsopycnon georgiae, new genus and species	----	----	----	------	(?)	----	----	----	------	------	----	----	?
TANYSTYLIDAE:													
Tanystylum orbiculare Wilson	----	----	----	X	----	X	S	X	------	------	----	----	Lit.–15
calicirostre Schimkewitsch	----	----	----	------	X	----	----	----	------	------	----	X	Littoral
COLOSSENDEIDAE:													
Colossendeis angusta Sars	X	X	----	X	----	----	----	----	------	------	----	----	86–1,700
colossea Wilson	----	X	----	X	----	----	X	----	------	------	----	----	499–1,374
minuta Hoek	----	----	X	------	----	----	----	----	------	------	----	----	811–1,250
macerrima Wilson	----	X	----	X	----	----	----	----	------	------	----	----	231–1,073
clavata Meinert	----	X	----	X	----	----	----	----	------	------	----	----	855–1,230
michaelsarsi Olsen	----	(?)	----	X	----	----	----	----	------	------	X	----	858
Pentacolossendeis reticulata Hedgpeth	----	----	----	------	----	----	X	----	------	------	----	----	98–110
PYCNOGONIDAE:													
Pycnogonum littorale (Ström)	X	----	X	X	----	----	(?)	----	X	X	X	----	Lit.–810
crassirostre Sars	X	----	X	------	----	----	----	----	X[N]	------	----	----	129–207
reticulatum, new species	----	----	----	------	----	----	X	----	------	------	----	X	Littoral
Pentapycnon geayi Bouvier	----	----	----	------	----	----	X	----	------	------	----	----	38

NEW ENGLAND

The southern limit of the characteristic Boreal-Arctic fauna in the western North Atlantic is Cape Cod, and most of the pycnogonids from the New England-Newfoundland region are widely distributed in the colder waters of the North Atlantic (fig. 6). *Nymphon hirtipes*,

FIGURE 6.—Distribution of various cold- and warm-water pycnogonids (from various sources).

N. longitarse, and *Pseudopallene circularis* are typical species of this region. Except for a single deep-water record for *Nymphon longitarse* at about latitude 40° N., these species are not found south of Cape Cod. There seem to be only two species that might be considered indigenous to the New England region, *Achelia spinosa* and *A. scabra*. But *Achelia spinosa* is considered to be synonymous with the European *A. echinata* by several writers.

Few littoral species have been collected from both the Gulf of Maine region north of Cape Cod and the Woods Hole area immediately

south of the Cape. The species known to occur regularly on both sides of this limiting promontory are *Pycnogonum littorale*, *Phoxichilidium femoratum*, *Nymphon grossipes*, and *Achelia spinosa*. Three of these are ubiquitous Boreal species whose southern limit seems to be Long Island Sound.[6]

FIGURE 7.—Occurrence of pycnogonids on sargassum in the mid-Atlantic (after Timmermann, fig. 3).

The pycnogonids of Woods Hole are notably few. Only three species are common in that locality: *Tanystylum orbiculare*, *Callipallene brevirostris*, and *Anoplodactylus lentus*. The last two have been reported from the Bay of Fundy, but both records are of single specimens. They can be considered accidental vagaries if not errors in identification or labeling. All three species are widely distributed southern forms, and Woods Hole represents their northern optimum limit. The pelagic sargassum species *Endeis spinosa* occurs sporadically at Woods Hole when sargassum drifts into that region. Curiously enough, *Anoplodactylus petiolatus* has not been collected at Woods Hole, although it seems to be more common in floating sargassum than *Endeis spinosa* is (fig. 7).

[6] Stephensen's (1933) record of *P. littorale* from Barbados is not supported by the collections examined; it may be a result of mislabeling.

Cole (*in* Sumner, Osburn, and Cole, 1913) suggested two other species as possible members of the Woods Hole fauna: *Nymphon grossipes* and *Pycnogonum littorale*. They are yet to be collected from that precise locality.

THE CARIBBEAN

Thirty-four species and 16 genera of pycnogonids have been identified from the Caribbean region, most of them from the vicinity of the Tortugas Marine Laboratory of the Carnegie Institution of Washington, and Key West, Fla. Several of them were originally described from such widely scattered localities as Norway, Naples, Cape Verde, and the Galápagos.

The characteristic element of this fauna is the genus *Anoplodactylus*. This genus is predominantly tropical and is as characteristic of warm-water regions as *Achelia* is of temperate latitudes and *Nymphon* is of the colder water of the higher latitudes. *Anoplodactylus* is represented in the West Indies by at least 13 species. Two of these, *Anoplodactylus lentus* and *A. insignis*, appear to be common, but the others are represented by one or two specimens or sporadic collections. The relatively large size and conspicuous coloration of these two species may account for this greater apparent abundance. *Anoplodactylus lentus* often has a spread of nearly 3 inches (7.5 cm.) and is of a deep purple color, and *A. insignis* is well over an inch in extent (2.5^{+} cm.), with prominent angular processes on the joints of the legs.

The species of *Anoplodactylus* from the Tortugas region are listed in table 2 (*A. carvalhoi* has been collected from the Virgin Islands but is not yet known from Tortugas).

The occurrence of *Anoplodactylus polignaci* off Sombrero Key, Fla., is of interest in connection with Bouvier's (1914a) opinion that its

TABLE 2.—*Species of* Anoplodactylus *from the Tortugas region*

Species	Number of collections from Tortugas and vicinity	Type locality	Distribution
lentus	3	Woods Hole, Mass.	South Carolina; Gulf of Mexico.
insignis	5	Bahia, Brazil	Bermuda; Cape Hatteras.
typhlops	1	Trondheim, Norway	Norway; off Iceland.
?*maritimus*	1	From sargassum, south of Azores.	
polignaci	1	Cape Verde	
evelinae	2	Santos, Brazil	
quadratispinosus	(1)	Key West, Fla.	
stylirostris	1	Tortugas, Fla.	
pectinus	2	do	
sp. A	1	do	
sp. B	(1)	Off Cape Canaveral, Fla.	[May be *massiliensis* from Mediterranean and North Africa.]

apparent relationship to *A. insignis* from Brazil was a point in favor of the theory of drifting continents, as he supposed the two species had become differentiated since the formation of the Atlantic Ocean.[7]

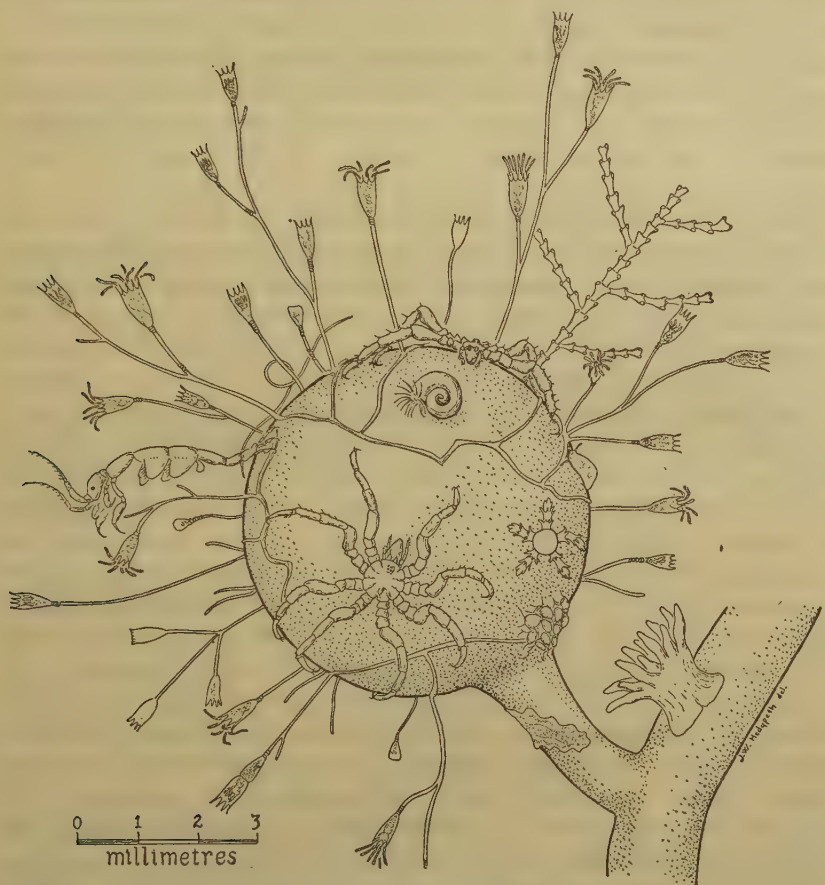

FIGURE 8.—The fauna of a sargassum bladder, including *Tanystylum orbiculare* Wilson.

As Marcus (1940b, p. 60) has remarked, the evidence that pycnogonids are in some instances subject to passive distribution makes such bold speculations unwarranted. Now that *A. polignaci* has been found on both sides of the Atlantic (together with several other species) Bouvier's theorizing is untenable. Furthermore, *A. polignaci* is apparently not so closely related to *A. insignis* as Bouvier supposed; while *A. insignis* is a very variable species, none of its variations indicate a close connection between the two species.

[7] For arguments against Wegener's theory of recent continental drift, see James Johnstone, "A Study of the Oceans," pp. 212–213, 1930, and R. W. Chaney, "Bearing of Forests on the Theory of Continental Drift," Sci. Monthly, Dec. 1940, pp. 489–499.

It is more reasonable to assume that such species have migrated as adults on the sargassum or as larvae in hydroids on the sargassum or in the medusa stage of the hydroid host.[8] Timmermann (1932), in his study of the fauna of the pelagic sargassum, discovered that two pycnogonids, *Endeis spinosa* and *Anoplodactylus petiolatus*, are apparently characteristic elements of this fauna, and Hodgson (1915) vaguely described another species, *Anoplodactylus maritimus*, from sargassum south of the Azores. Recently I have taken *Tanystylum orbiculare* from sargassum cast ashore on the Gulf coast of Texas. (Fig. 8.)

The fact that *Endeis spinosa* is common in the Tortugas region (it has also been found on the coast of South Carolina, in Chesapeake Bay, and at Bermuda) supports Timmermann's tentative suggestion that it might be an American species that owes its wide distribution along the coast of Europe to its pelagic habit. The apparent scarcity of *Anoplodactylus petiolatus* on the American side of the Atlantic would seem to contradict this explanation, especially since it is more common on the sargassum in mid-Atlantic than *Endeis spinosa*. However, it has been collected from sargassum on the Texas coast, while *Endeis spinosa* is yet to be collected from that part of the Gulf of Mexico. Nevertheless, *Endeis spinosa* is widely spread along the American Atlantic coast, from Brazil to Woods Hole, including the Panama region. It is possible that Giltay's *Anoplodactylus parvus* is the same species as *A. petiolatus*, in which case the American range of *A. petiolatus* would include Chesapeake Bay and Bermuda.

In addition to the two pycnogonids of known pelagic occurrence, at least eleven species are found on both sides of the Atlantic, exclusive of the Boreal-Arctic species, which have a more continuous distribution. Seven of these are found in the Tortugas-Key West region alone. It will be noted, from table 3, that two species, *Ammothella appendiculata* and *Endeis charybdaea*, have been found on the coast of southern Brazil but are not represented in the Tortugas collections. Their absence from the Florida Keys cannot be presumed from available evidence, and two species described from Brazil have been found in the area. It is probable that southern Brazil is the meeting place of the American tropical and the Magellanic faunas.[9]

The distribution of these species, several of them collected at the surface, appears to represent a dispersion from the rich Caribbean fauna rather than a concentration of widely scattered elements in that region. On the other hand, the Mediterranean fauna might be considered a concentration of European Boreal types and American Subtropical forms. The possibility that the Caribbean is a center of

[8] Larval stages of *Anoplodactylus petiolatus* have been found in medusae by Lebour (1916 and 1945).

[9] Only two isolated collections from the equatorial coast of eastern South America have been recorded in the literature: *Pentapycnon geayi* Bouvier (French Guiana) and *Nymphopsis anarthra* Loman (Venezuela).

dispersal for these forms gains some confirmation from a comparison of the pycnogonids from both sides of the Isthmus of Panama. Fourteen of the 20 genera known from the two regions (Cape Hatteras to about latitude 10° N. on the Atlantic side, Point Concepción to the Galápagos on the Pacific side) are represented in both faunal provinces. Three species occur in both regions (the records for two of them antedate completion of the Panama Canal):

Nymphopsis duodorsospinosa	Tortugas and South Carolina; Galápagos and Baja California.
Tanystylum calicirostre	Bermuda; Gulf of Panama.
Pycnogonum reticulatum	Tortugas and Key West; El Salvador.

There are also at least five pairs of closely related species, which may have become differentiated after the rising of the Isthmus:

Caribbean region	Panamic region
Callipallene	
*emaciata** (Tortugas)	*californiensis* (southern California)
Ammothella	
rugulosa (Brazil, Bermuda, Tortugas)	*heterosetosa* (Galápagos)
Ascorhynchus	
*armatus**† (Hatteras to Cuba)	*agassizi*† (Gulf of California)
Eurycyde	
raphiaster (Tortugas)*	*longisetosa* (Colombia)
Tanystylum	
*orbiculare**? (Brazil, Florida, Texas)	*duospinum* (central California)

†Deep-water species, possibly synonymous.
*Also from east side of Atlantic.

An interesting anomaly is the occurrence of species of *Anoplodactylus* with styliform probosces at Tortugas and the Hawaiian Islands. Although they are apparently not the same species, *A. stylirostris*, new species (Tortugas), and *A. intermedius* Hilton are evidently closely related.

WEST AFRICAN PYCNOGONIDS

Unfortunately our knowledge of the west African pycnogonids is incomplete, and future collections from that region may convince another investigator that such species as *Anoplodactylus polignaci* and *Eurycyde raphiaster* owe their distribution to the influence of the westward-flowing North Equatorial Current rather than to the Gulf Stream. The richness of the Caribbean fauna indicates that it is a more favorable region for the development of species (as does the

TABLE 3.—*Pycnogonids occurring on both sides of the Atlantic*

Species	Tortugas-Key West records	Other Western Atlantic	Eastern Atlantic
Anoplodactylus petiolatus		Hatteras, Texas, Southern Brazil, Sargasso Sea.*	Europe, from lat. 69° N. to Mediterranean, Plymouth*.
pygmaeus		Virginia, Texas	Ireland, England, Mediterranean.
typhlops	1		Norway, Ireland.*
(?*maritimus*		Off Habana	South of Azores.*)
polignaci	1		Cape Verde.
Halosoma robustum	1	Southern Brazil	Mediterranean.
Callipallene brevirostris		Woods Hole*, Chesapeake Bay.	European coast, France.*
phantoma	1*		Norway to Naples, Azores.
emaciata	2*		France, Mediterranean.
Pigrogromitus timsanus		Lake Worth, Fla	Suez Canal.
Ammothella appendiculata		Southern Brazil	Naples.
Eurycyde raphiaster	2	Bahamas, Dominican Republic, Colombia.	Cape Verde.
Endeis spinosa	10 (2*)	Brazil, Bermuda, Panama, Florida to Woods Hole, Sargasso Sea.*	Norway to Mediterranean, Black Sea, Azores.
charybdaea		Southern Brazil	Naples.

*Pelagic or tow-net records.

occurrence of two decapodous forms in the region) than the narrow, current-swept coast of west Africa. Another objection to this alternate explanation, on the basis of the present known distribution, is the absence of the European *Nymphon gracile* from the West Indies. This species has been taken at the surface in considerable numbers at Banyuls-sur-Mer (Fage, 1932), but it does not appear to be related to *Nymphon floridanum*, which has been collected at Tortugas in surface tows.

PYCNOGONIDS FOUND ON OR NEAR THE WEST COAST OF AFRICA

Nymphon gracile Leach
- *gruveli* Bouvier
- *longituberculatus* Olsen
- *cognatum* Loman
- *adami* Giltay
- *mauritanicum* Fage
- *prolatum* Fage

Anoplodactylus massiliensis Bouvier
- *polignaci* Bouvier

Endeis spinosa (Montagu)
- *charybdaea* (Dohrn) var. *bispinata* Bouvier

Achelia echinata Hodge
- *longipes* Hodge
- *langi* (Dohrn)
- *armata* Bouvier

Ascorhynchus arenicola (Dohrn)
- *armatus* (Wilson)
- *similis* Fage

Eurycyde raphiaster Loman

Clotenia conirostris (Dohrn)

Colossendeis angusta Sars
- *colossea* Wilson
- *macerrima* Wilson
- *michaelsarsi* Olsen

Pycnogonum littorale (Ström)
- *nodulosum* Dohrn

Thanks to the investigations of the *Vanneau* along the coast of Morocco, the recently published papers on the collections of the *Talisman* (Bouvier, 1937), and *Président Théodore-Tissier* (Fage, 1942), and to other records, 24 or 25 species of pycnogonids have been identified from the west coast of Africa north of the Equator. Olsen's description of *Nymphon longituberculatus* in the *Michael Sars* Report (1913) seems to have been overlooked by other workers. *Nymphon cognatum* Loman (1928b) is very similar to Olsen's species and may be the same. The deep-water species included in the list above were all taken between the coast of Africa and the Canaries or the Azores.

BERMUDA

The collections from Bermuda are not altogether satisfactory, yet there is reason to believe that the littoral pycnogonids of that island are well represented in the collections. Both Verrill and Cole, who were especially interested in the sea spiders, collected extensively at Bermuda. With the exception of material that may be buried in the collections of the New York Zoological Society, I have seen all the museum material from Bermuda and have been advised by Dr. Isabella Gordon that the British Museum has no collections of pycnogonids from the island. The known species from Bermuda are:

Anoplodactylus insignis
Anoplodactylus parvus
Achelia gracilis
Ammothella rugulosa
Tanystylum calicirostre
Endeis spinosa

As might be expected, most of these species are found on the coast of the United States or in the Caribbean. *Tanystylum calicirostre*, however, is yet to be found in the Caribbean, although its occurrence in Bermuda and the Gulf of Panama suggests its presence there. There appears to be no endemic species in Bermuda. Although Giltay's (1934b) record of *Achelia gracilis* from the Bahamas is not supported by the collections examined, the species is found on the Florida coast. The absence of *Anoplodactylus petiolatus* is curious in view of its wide distribution on the sargassum, but it is possible that Giltay's *A. parvus* is a form of that species. In any event, the species is rare in Bermuda, or else it has been overlooked. In view of the distribution of various small species on both sides of the Atlantic, it is strange that more of them have not been found at Bermuda.

An additional species, *Calypsopycnon georgiae*, may be from Bermuda. It is known only from an unlabeled slide mount found in the collections of A. E. Verrill, which he may have collected on one of his trips to Bermuda, although it is equally possible that it may have been taken from an *Albatross* dredge collection.

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THE ATLANTIC AND PACIFIC COASTS

Although there are several similarities between the pycnogonids of the Caribbean and Panamic regions, the species found on the temperate continental shores of the opposite coasts of North America have little in common. The west coast, with its characteristic bold cliffs and outlying reefs, accompanied by the upwelling of cold water from offshore deeps, has limited the distribution of littoral species, with the result that a large number of closely related species have been developed. On the east coast the predominant geographical features are the long reaches of sandy beaches and outlying shoals, washed by the warm, northward-flowing Gulf Stream. These conditions are correlated with a sparse fauna of widely distributed species south of Cape Cod and north of Florida.

There are some comparable geographical features on the two coasts. These are the Bay of Fundy and Puget Sound, both deeply indented regions with Boreal-Arctic elements in their faunas, and Cape Hatteras and Point Concepción, which are the northern limits of many Tropical species of marine invertebrates on their respective coasts.

The similarities between the pycnogonids of the Bay of Fundy and Puget Sound are best understood from the following tabulation:

Bay of Fundy	Puget Sound
Nymphon	
grossipes	*grossipes*
longitarse	*pixellae**
strömi	
Phoxichilidium	
femoratum	*femoratum*
Achelia	
spinosa	*alaskensis*
scabra	*harrietae*†
	longicaudata‡
Pseudopallene	
circularis	**
Pycnogonum	
littorale	*stearnsi*

*Closely related to *N. longitarse*, which is reported from Alaskan and Japanese waters.
†New name for *discoidea* Exline (Marcus, 1940b, p. 129)
‡ Unidentifiable species, possibly *A. latifrons* or *alaskensis*.
**A closely related species, possibly the same, is reported from Alaskan waters, and may also occur in Puget Sound (*Pseudopallene setosa* Hilton, 1942c).

Along the coast of California there are several localities from which at least twice as many species are known as are included in the perma-

nent fauna of Woods Hole. At Dillon Beach (about 40 miles north of San Francisco), for example, 9 species have been collected. About 21 species have been described from the central California coast, 14 of which have been collected in the vicinity of Pacific Grove.[10] Of particular interest is the large number of species of *Achelia* and *Tanystylum* on the California coast.

The occurrence of so many endemic species on the California coast, together with the physical conditions (upwelling of cold water and bold headlands) that limit their distribution, brings to mind the suggestion of Marcus (1940a, p. 197) that the limited locomotive powers of the Pycnogonida as a group have influenced the development of a large number of closely related species. The wider distribution of many species in the Atlantic, apparently associated with the Gulf Stream and floating sargassum, is not duplicated elsewhere and supports rather than disproves this hypothesis.

A few characteristic North Pacific species are found along the west coast as far south as the vicinity of San Pedro: *Pycnogonum stearnsi*, *Phoxichilidium femoratum*, and *Lecythorhynchus marginatus*. The Boreal *Nymphon grossipes* has not been collected south of Puget Sound.

In brief, the pycnogonids of the east coast south of Woods Hole are southern species that have worked their way northward, whereas the California coastal fauna is a mixture of endemic species, northern forms, and such southern species as *Anoplodactylus erectus*, *Tanystylum intermedium* (both found as far north as Pacific Grove), *Nymphopsis spinosissima*, and *Pycnogonum rickettsi* (northernmost records, Dillon Beach).

Although at least three species of pycnogonids have been taken in tow nets in the Japanese region (Ohshima, 1933), few northwestern Pacific species are found on the American coast. The anomalous and puzzling distribution of *Ammothella bi-unguiculata* (Naples, southern California, Hawaii, and Japan) is the most conspicuous example. The distribution of the genus *Lecythorhynchus* (Ammotheidae) may be of more zoogeographical significance. One species, *L. hilgendorfi*, is known from the western Pacific, and another, *marginatus*, is a character species of the California coast. Hilton (1942d) has described a third species of this genus, *L. ovatus*, from Hawaiian waters.

SYSTEMATIC DISCUSSION

The literature on the Pycnogonida is fantastically large and is scattered in dozens of bulletins, journals, and proceedings, many of them unavailable even in the largest libraries. Type material has fared no better; as Calman (1923, p. 267) sourly remarks, specimens

[10] For further information concerning California species see Hedgpeth (1941) and Hilton's numerous preliminary papers, listed in the bibliography.

are distributed in museums "as widely scattered as were the original habitats." I have tried to make this review as complete as possible so that students interested primarily in biological oceanography and invertebrates in general can use it without recourse to scattered papers. Drawings have been made of all the species examined, usually from unmounted material, with the aid of a camera lucida. Thus the element of perspective must be taken into consideration when studying the drawings, and extreme examples of foreshortening are indicated whenever they occur. The measurements of the larger specimens were made with a pair of dividers; for the smaller specimens the following system was used: A series of millimeter scales, enlarged with the camera lucida by various lens combinations, was prepared, and the object to be measured was projected by the lucida against the appropriate scale. Of the 70 species discussed in this paper, 9 are described as new (3 of these have been indicated by preliminary diagnoses in an earlier paper, 1943b), and 2 referred to their genus.

No attempt has been made to include complete synonymies of well-known species, but all important local references, insofar as I have been able to find them, have been included.

Unless otherwise indicated, the material listed is in the United States National Museum. Material from other museums is referred to by the following abbreviations: the Museum of Comparative Zoology at Harvard, M. C. Z.; the Peabody Museum of Natural History at Yale, Y. P. M.; the American Museum of Natural History, New York City, A. M. N. H. This system has not been used for the *Albatross* collections, individual lots of which are about evenly divided between the National Museum and the Peabody Museum. The number of specimens listed from each *Albatross* station has been compiled from the collections now in these two museums and does not represent the original collection in many instances, since no complete records have been kept of specimens sent to European museums from time to time. The more complete set, including specimens of all the species mentioned, is in the National Museum.

The taxonomy of the larger genera (e. g., *Nymphon*, *Colossendeis*, *Achelia*, *Anoplodactylus*) is in a sad state of disrepair, but revision of their species must await that unrealized millennium when existing types and scattered collections are available to one specialist for redescription and comparison. Collections from European and Arctic regions have been accumulating for more than a hundred years, and the inadequate descriptions of earlier workers have resulted in an almost hopeless tangle, which academic taxonomists have done little to unravel.

The most outstanding recent taxonomic papers on the Pycnogonida are Gordon's *Discovery* Report (1932), with its fine review of the

Antarctic species, and Marcus's (1940b) excellent catalog of the Brazilian and South American pycnogonids. Bronn's Tierreich monograph by Helfer and Schlottke (1935) is the first general account of the class as a whole, but it is marred by minor errors in the bibliography and the haphazard treatment of several generic names. Of the older monographs, those by Dohrn (1881) on Mediterranean species and Sars (1891) on the Norwegian species are classics and indispensable references. Both are beautifully illustrated.

The determined reader who ventures into the following pages in search of further enlightenment will do well if he survives with any vestige of the patience that has served him this far. Why are species in some genera separated by characters ignored in other genera, why this dwelling on the lengths of claws, or this petty quibbling over names themselves? He will soon suspect that "species" are subjective appraisals, that the conception of what constitutes a species varies with the one who specifies. In the words of the late Dr. Tate Regan, "A species is a community, or a number of related communities, whose distinctive morphological characters are, in the opinion of a competent systematists, sufficiently definite to entitle it, or them, to a specific name." As Julian Huxley observes, in commenting on this definition, the difficulty is in the word "competent." "And experience," he continues, "teaches us that even competent systematists do not always agree as to the delimitation of species."[11]

This, of course, is another way of suggesting that a species is perhaps an anthropomorphic conception rather than a natural entity. As Darwin said, "No one definition has satisfied all naturalists, yet every naturalist knows vaguely what he means when he speaks of a species." It does not seem, however, that a species is as artificial as it appears to be in taxonomic papers—the fault is not in our species but in ourselves—and I cannot agree with the famous remarks in the conclusion of the "Origin of Species": "We shall have to treat species in the same manner as those naturalists treat genera, who admit that genera are merely artificial combinations made for convenience. This may not be a cheering prospect; but we shall at least be freed from the vain search for the undiscovered and undiscoverable essence of the term species." Darwin was an optimist; we are more deeply engrossed in that vain search than ever, standing, in the words of Henry Adams, on the shore of a sunless sea, "diving for pearls and never finding them."[12]

That the taxonomist is a practitioner of a branch of metaphysics has been suspected by some writers, although few have explicitly

[11] Julian Huxley, "Evolution: The Modern Synthesis," p. 157, 1943.

[12] Leon J. Cole, who began as a pycnogonid student and is now a geneticist, has presented an interesting discussion of these matters in his article "Each after his Own Kind," Science, vol. 93, pp. 289–293, 316–319, 1941.

stated as much. Unfortunately, the philosophical basis of taxonomic procedure has not been adequately examined. The only discussion of taxonomy as a branch of philosophy with which I am familiar is that by J. S. L. Gilmour in "The New Systematics." [13] At best this is inconclusive—first we must have an "epistemological theory of how scientists obtain knowledge of the external world" before principles underlying the process of classification can be examined. As philosophy is already a graveyard of outworn epistemological theories, this is hardly encouraging.

Whatever taxonomists may decide a species to be, it appears to the philosopher as a dynamic expression of force, a conception which, if accompanied by a denial of teleology, leaves us peering ironically into the abyss of ignorance in company with the frustrated Mr. Adams, still in search of an education, that endless quest for the answer to the problem of unity and multiplicity. Perhaps a mere museum taxonomist, working over specimens that come from regions he has never visited and that have been preserved in basements for 60 years, has no business diving for pearls or tripping the light fantastic on the edge of his own abyss of ignorance. Yet all is grist for the mills of knowledge and philosophy, and no one can say that a particular oyster does not contain a pearl until he opens it.[14]

There seem to be a few meager seed pearls in the thorny oyster of pycnogonid systematics. The suggestion that a species is a dynamic expression of biological force, and that genera are abstractions representing historical events, "dynamic unities in the past," enables one to contemplate the large genera, the bizarre species *sui generis*, and the 10-legged forms with some sense of coherence or form.[15] Considering a genus as a historical idea, we can regard the genus *Nymphon* as the result of a singularly well adapted dynamic unit, which has expanded in many directions—to more than 90 taxonomic species, in fact. Continuing this line of reasoning, the monospecific genera in such families as the Ammotheidae and Tanystylidae are really species with a low dynamic potential—only when a species becomes so differentiated that it is more than one, when it has begun to display multiplicity in its unity, so to speak, can it be called a member of a genus. By rising to generic rank an original species has become "extinct" and has been replaced by its descendants but has gained in dynamic force. Ten-legged forms, labeled genera for convenience, must be further

[13] Taxonomy and Philosophy, in "The New Systematics," pp. 461–474. Edited by Julian Huxley, Oxford, 1940.

[14] Thoreau, somewhere, describes the pearl as "a hardened tear of a diseased clam, murdered in its old age." Pearls of wisdom secured by injudicious diving into the absolute may have the same dubious antecedents.

[15] This conception is discussed at length by Hugh Miller, in "History and Science: A Study of the Relation of Historical and Theoretical Knowledge," 201 pp., Berkeley, 1939. "Our purpose is to free empirical science from the ghosts of the rationalistic past that still haunt and mislead its progress." Nevertheless, the ghosts of teleology and purpose still haunt me.

expressions of the dynamics behind the 8-legged species they resemble. It cannot be an accident of a mechanistic universe that these 10-legged forms occur in groups whose success is already indicated by their large contingents of closely related "normal" species.

Why, then, have I retained artificial species, genera, and families, insisting on keeping the Tanystylidae separate from the Ammotheidae, and indulging in other inconsistencies? The principal reason, aside from the perennial problem of simplifying classification for reference purposes after the manner of a library catalog system, is the recognition of divergence within the group. The Pycnogonida is a young group, albeit an apparently useless one by anyone's teleology or economic interests, and if the dynamic force that is expressing itself in this particular group of organisms continues, the lines of divergence, now conceived as arbitrary, may become broader in time and be recognized as "natural" divisions by the taxonomists of a subsequent millennium.

In the meanwhile, we must proceed with our subjective appraisals of species. I regret the necessity for describing species on the basis of single specimens, for giving the same name to groups that are alike, but yet not quite the same, e. g., the Brazilian and North Atlantic forms of *Tanystylum orbiculare* and the northern and southern forms of *Nymphon macrum*, and other vagaries of my human imperfection, splitting or lumping as seems best at the moment. But if we made it a hard and fast rule not to describe a species from a single specimen, we would have to wait some time for information concerning the extent of divergence and variation within the group. Some of these creatures dredged from the bottom of the sea may never be found again, and statistical or comparative methods require, for perfection, more material than is available even in some of the largest series before me. And even an amateur does not have all the time he would like to have to devote to his studies. Eventually the taxonomists of the great museums will devise methods for such organisms as the pycnogonids, involving perhaps the use of extensive series of superimposed camera-lucida drawings or photographs, which will clarify the status of species in such aggregates as *Nymphon*. Until that happy day, the present methods, as applied in the following pages, will have to do.[16]

Family NYMPHONIDAE Wilson, 1878

Ovigers 10-jointed, in both sexes. Chelifores chelate, 2-jointed; palpi 5-jointed. With one decapodous genus.

In agreement with other writers, particularly Calman (1915a) and

[16] Some possible ways of dealing with the taxonomic problems reviewed above are discussed by Isaac Ginsburg, in "Divergence and Probability in Taxonomy." Zoologica, vol. 25, No. 1, pp. 15–31, 1940. Other references will be found in his paper. This discussion was written before I had read Mayr's "Systematics and the Origin of Species."

Gordon (1932), *Chaetonymphon* Sars, 1891, is reunited with *Nymphon* J. C. Fabricius, 1794. The three species occurring in the western North Atlantic, which have been previously referred to *Chaetonymphon*, form a natural group and are considered under group A of the genus as a matter of convenience (fig. 9).

The former inclusion of *Paranymphon* Caullery in the Nymphonidae is not so much an indication of its natural relationships as it is of the artificial nature of the families in the Pycnogonida. It differs from all the Nymphons in having an unsegmented body and blunt 7-jointed palpi. In its assemblage of anomalies it resembles *Ainigma* Helfer (1938).

Ainigma ornatum is a small, delicate form from the Agulhas Bank off South Africa, having very high dorsal tubercles at the ends of the lateral processes, tapered tarsal joints without auxiliary claws, and an oviger with a few large denticulate spines and a simple large terminal spine. These characters it shares with *Paranymphon spinosum*, but the segmented trunk, large proboscis, 2-jointed chelifores (the chelae are mere knobs), and 9-jointed palpi of *Ainigma* entitle it to a place in the Ammotheidae. The genital protuberances are on the femurs instead of the second coxae. One is inclined to wonder whether these two queer genera are not more closely related to each other than they are to the families in which they have been included. Therefore I have removed *Paranymphon* from the Nymphonidae and placed it in the Ammotheidae.

Four genera are included in the Nymphonidae, one of which (*Boreonymphon*) is monospecific. *Pentanymphon* and *Heteronymphon* are represented by two species each. Following is a key to the genera of the Nymphonidae:

1. Four pairs of legs 2
   Five pairs of legs (Antarctic) ..... **Pentanymphon** Hodgson
2. Fingers of chelae denticulate, eye tubercle usually present 3
   Fingers of chelae not denticulate, strongly bowed and with opposed tips; eye tubercle reduced to a minute pimple (Arctic) ... **Boreonymphon** G. O. Sars
3. Eye tubercle at base of neck between first pair of lateral processes; oviger with terminal claw ..... **Nymphon** (p. 180)
   Eye tubercle forward, near base of chelifores; oviger without terminal claw (Antarctic) ..... **Heteronymphon** Gordon

Genus NYMPHON J. C. Fabricius, 1794

(including *Chaetonymphon* G. O. Sars, 1891)

Chelifores 2-jointed, chelate, chelae well developed. Palpi 5-jointed. Ovigers present in both sexes, 10-jointed, terminal joints with denticulate spines and a terminal claw on the last joint. Body segmented, usually elongate but never tightly compact. Propodus without heel but usually with auxiliary claws.

The taxonomy of the Boreal-Arctic and Tropical species of *Nymphon* is in such a chaotic state that it is with some hesitation that I propose two new species for the genus. Ninety or a hundred species have been assigned to this unwieldy genus, yet there seems to be no end to the variations of trivial characters on which the species are based. Although *Nymphon* attains it maximum development of species and numbers of individuals in the Arctic and Antarctic regions, species are by no means rare in tropical regions, and, as Giltay (1937, p. 87) remarked, more will probably be found by future collectors.

Ten species of *Nymphon* have been identified from the regions considered in this report, and three more occur within the northern limits of the area. As they are usually Arctic species, they have been included in the key in brackets in order to keep the key as simple as possible. The species south of Newfoundland fall into two groups: A, *spinosissimum*, *hirtipes*, and *tenellum*, which have a heavily setose trunk and legs and rather short tarsal joints in proportion to the propodus; and B, *grossipes*, *longitarse*, *strömi*, *rubrum*, *macrum*, *giltayi*, and *floridanum*, which are characterized by the lack of closely set setae on the trunk and legs, and, except for *floridanum*, by relatively long tarsal joints.

The collection of *Nymphon sluiteri* Hoek from the Gulf of St. Lawrence in 1932 indicates that this species may be a rare member of the New England–Newfoundland fauna, although this is the extreme southern record for this species. Another Arctic species, common on the coast of Greenland and in Fox Basin, *Nymphon brevitarse* Krøyer, occurs as far south as the Strait of Belle Isle but so far is unknown from the southern part of Newfoundland. A third Arctic species, *Nymphon elegans* Hansen, was taken by the *Godthaab* at station 14, latitude 55° N., longitude 56°34′ W. (off Labrador), and may be expected at moderate depths off Newfoundland.

KEY TO WESTERN ATLANTIC NYMPHONS SOUTH OF NEWFOUNDLAND

1. Tarsus half as long or less than half as long as propodus 2
   Tarsus almost as long as or longer than the propodus 5
2. Lateral processes separated by their own width or less; legs and trunk setose .. 3
   Lateral processes separated by more than their own width; legs and body not thickly setose ..... **floridanum**, new species (p. 196)
3. Lateral processes separated by less than half their own width; neck about as long as wide 4
   Lateral processes separated by more than half their own width; neck slightly longer than wide ..... **tenellum** (p. 185)
4. Auxiliary claws at least half as long as terminal claw .. **spinosissimum** (p. 183)
   Auxiliary claws about one-fourth as long as terminal claw .. **hirtipes** (p. 183)
5. Fingers of chelae comparatively thick, shorter than palm, a few large spines on sole of propodus 6
   Fingers of chelae slender, usually long or longer than palm; without large spines on sole of propodus 7

6. Small (less than 2.5 cm. in extent); large spines on propodus as long as diameter of joint, widely spaced, on proximal half ..... **rubrum** (p. 192)

[Neck about as long as proboscis (shorter in *N. rubrum*); joints of palpi rather thick in proportion to their lengths; coxae without the prominent lateral spines of *N. rubrum;* spines on propodus about half as long as diameter of joint (Strait of Belle Isle, northward) ..... *brevitarse* Krøyer]

Medium sized (3 cm. or larger); spines on propodus not so long as diameter of joint ..... **grossipes** (p. 187)

7. Auxiliary claws less than one-fourth as long as terminal claw 8

Auxiliary claws one-half to two-thirds as long as terminal claw 9

8. Neck short; chelae with more than 25 large spinules on each finger, tips pointed ..... **strömi** (p. 190)

[Neck moderately long; fingers of chelae curved sharply at tips, dactylus blunt or spatulate at tip; auxiliary claws more than one-fourth but less than half as long as terminal claw ..... *elegans* Hansen]

Neck long, slender; chelae with 25 or less small spinules on each finger; tarsus twice as long as propodus ..... **longitarse** (p. 190)

[Tarsus slightly longer than but not twice as long as propodus; terminal claw about as long as propodus, auxiliary claws minute (Gulf of St. Lawrence) ..... *sluiteri* Hoek]

9. Eye tubercle low, without eyes; fingers of chelae not conspicuously longer than palm, with less than 25 spinules on either finger .. **giltayi**, new species (p. 195)

Eye tubercle prominent, eyes present; fingers of chelae longer than palm, with more than 50 spinules ..... **macrum** (p. 193)

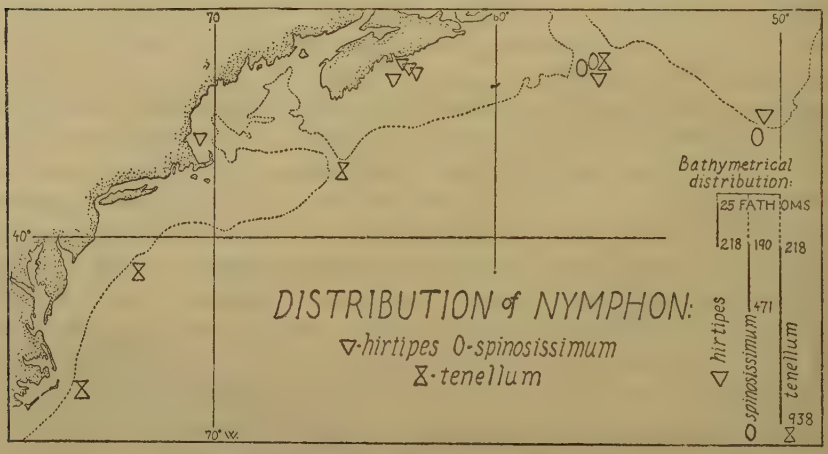

FIGURE 9.—Distribution of group A Nymphons.

GROUP A

Although the three species in this group resemble one another so closely that they have often been confused, their distribution is different. *Nymphon tenellum* is about half the size of the other species and its appendages are more slender in proportion to their lengths. *Nymphon spinosissimum* and *hirtipes* are thickset-looking animals. As can be seen from the accompanying map (fig. 9), the only locality from which all three species of this group have been collected is the trough between Newfoundland and Nova Scotia, which marks the submarine extension of Cabot Strait.

The occurrence of *Nymphon tenellum* off Cape Hatteras in 938 fathoms is the deepest record for any *Nymphon* in American waters.

NYMPHON SPINOSISSIMUM (Norman)

FIGURES 10, *a*; 11, *a*

Chaetonymphon spinosum SARS (*nec* Goodsir), 1891, pp. 107–109, pl. 11, fig. 3, *a–i*.
Chaetonymphon spinosissimum NORMAN, 1894, p. 154; 1908, pp. 219–220.
Chaetonymphon spinosum SCHIMKEWITSCH (part), 1930, pp. 335–336.
Chaetonymphon spinosissimum STEPHENSEN, 1933, pp. 6–8, fig. 2 (map); 1943, pp. 14–15, fig. 4 (map).

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2429	June 23, 1885	42 55 30	50 51 00	471	+25
2471	July 4, 1885	44 34 00	56 41 45	218	+10
2484	July 5, 1885	44 20 00	57 11 15	204	1♂, ov.
2486	do	44 26 00	57 11 15	190	2

This species is easily confused with *Nymphon hirtipes*, which it resembles in most particulars except the greater length of its auxiliary claws and usually heavier setae. Though there are specimens of *hirtipes* that are as setose as the usual *spinosissimum*, the latter species never has the bald appearance found in many specimens of *hirtipes*. *N. spinosissimum* is about 5 cm. in extent. Ovigerous males were taken in June and July from American waters.

Distribution.—A Boreal species, preferring deeper water than *Nymphon hirtipes*. Stephensen reports it from western Greenland and Davis Strait. Also from Norway and the Faroes, but not the British Isles.

NYMPHON HIRTIPES Bell

FIGURES 10, *b*; 11, *b*

Nymphon hirtipes BELL, 1853, p. 403, pl. 35, fig. 3.—WILSON, 1878b, pp. 22–23, pl. 5, figs. 2–3, pl. 6, fig. 2, *a–k*.
Nymphon hirtum WILSON, 1880, pp. 495–497, pl. 7, figs. 38–41.
Chaetonymphon hirtipes SARS, 1891, pp. 103–107, pl. 11, figs. 2, *a–k*.
Nymphon hirtum WHITEAVES, 1901, p. 264.
Chaetonymphon hirtipes STEPHENSEN, 1933, pp. 8–9, figs. 2, 10 (maps).—NEEDLER, 1943, pp. 11–12, fig. 14, *a–e*.—STEPHENSEN, 1943, pp. 9–14, figs. 2, 3 (maps).

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2430	June 23, 1885	42 58 30	50 50 00	179	1 (ov. ♂)
2471	July 4, 1885	44 34 00	56 41 45	218	2
2508	July 8, 1885	44 28 30	62 56 00	72	1

FIGURE 10.—*a*, *Nymphon spinosissimum* (Norman); *b*, *Nymphon hirtipes* Bell; *c*, *Nymphon tenellum* Sars.

This species, characterized by its short auxiliary claws, has been taken in past years in large numbers off Halifax. It is slightly larger than *N. spinosissimum*. In many specimens the setae are so fine that the animal is apparently bald.

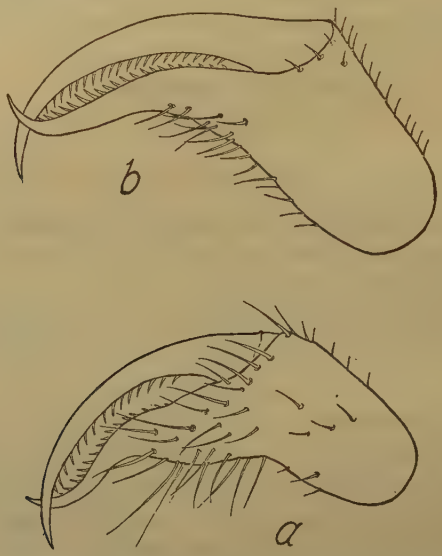

FIGURE 11.—*a*, Chela of *Nymphon spinosissimum*; *b*, of *Nymphon hirtipes*.

Distribution.—*Nymphon hirtipes* has a more Arctic distribution than *N. spinosissimum;* it is common off northwestern Greenland and Baffin Land. It is also found in the Barents and Kara Seas. Stephensen (1933) suggests that it may live on the coral *Eunephthya* and presents a map showing the coincidence of these organisms with *N. hirtipes* off western Greenland. In the New England region it has been collected as far south as Massachusetts Bay. Stephensen (1943) has a map showing the Arctic distribution of this species (fig. 3) and another (fig. 4) of its occurrence around Greenland.

NYMPHON TENELLUM (Sars)

FIGURE 10, *c*

Chaetonymphon tenellum SARS, 1888, p. 353; 1891, pp. 109–111, pl. 12, fig. 1, *a-h.*
Nymphon pallenoides WILSON, 1881, p. 254, pl. 3, fig. 14.—VERRILL, 1885, p. 561.
Nec *Chaetonymphon tenellum* MEINERT, 1899, p. 45.
Chaetonymphon tenellum STEPHENSEN, 1933, pp. 8–10.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2072	Sept. 2, 1883	41 53 00	63 35 00	858	1
2111	Nov. 11, 1883	35 09 50	74 57 40	938	1
2471	July 4, 1885	44 34 00	56 41 45	218	2
2528	July 13, 1885	41 47 00	65 37 30	677	10

The description accompanying Wilson's tentative identification of a specimen from *Blake* station 338 as *Nymphon pallenoides* Sars does not altogether agree with his figure of the tarsal joints. The tarsus is considerably longer than the same joint in *N. hirtipes*, but the long auxiliary claws are similar to those of *N. spinosissimum.* It is more slender in general appearance than either *hirtipes* or *spinosissimum* and is smaller, about 3.5 cm. in extent. It is evident that Wilson's specimen was *N. tenellum*, since Sars's *N. pallenoides* was later synonymized by him under *N. hirtum* (Sars, 1891).

Distribution.—*Nymphon tenellum* is not a common species. According to Stephensen, Meinert's records from west of Greenland are misidentifications. It appears to be a North Atlantic deep-water species.

GROUP B

Four species in this group are characteristic members of the invertebrate fauna of the New England region. Of particular interest are the southward extensions in range for *Nymphon strömi* and *N. macrum* (fig. 12). In addition to the localities indicated on the map, two specimens of *Nymphon* from south of Florida have been referred to *macrum*, although the tarsal joints and claws are heavier than in typical New England material.

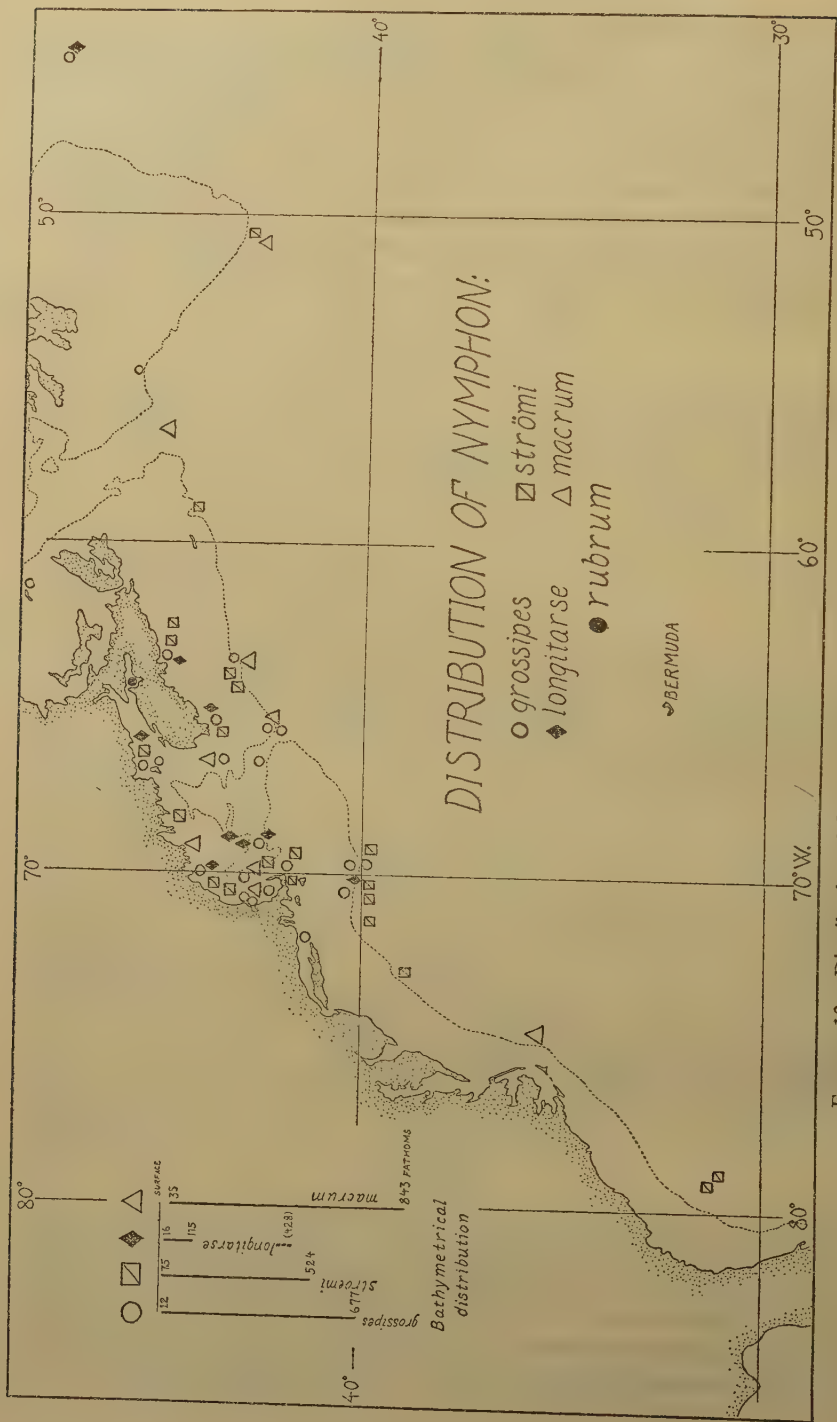

FIGURE 12.—Distribution of Group B Nymphons in the western North Atlantic.

NYMPHON GROSSIPES (O. Fabricius?) Krøyer

FIGURE 13, *a*

Nymphon grossipes FABRICIUS, 1780, p. 41.—STIMPSON, 1853, p. 38.—VERRILL, 1874b, p. 411; 1874c, p. 502.—WILSON, 1878b, pp. 20–22, pl. 17, fig. 1, *a-q*; 1880, pp. 491-494, pl. 6, figs. 32–37, pl. 7, fig. 42; 1881, p. 253.—VERRILL, 1885, p. 561.
Nymphon glaciale SARS, 1891, pp. 63–65, pl. 6, fig. 1, *a-q*.
Nymphon grossipes SARS, 1891, pp. 65–68, pl. 6, fig. 2, *a-i*.
Nymphon mixtum SARS, 1891, pp. 68–71, pl. 6, fig. 3, *a-i*.
Nymphon grossipes WHITEAVES, 1901, p. 264.—SUMNER, OSBURN, and COLE, 1913, p. 677.—STEPHENSEN, 1933, pp. 11–12.
Nymphon mixtum OHSHIMA, 1936, p. 682.
Nymphon turritum EXLINE, 1936, pp. 416–418, fig. 33, *g*, *k*.
Nymphon glaciale GILTAY, 1942, p. 459.
Nymphon grossipes NEEDLER, 1943, pp. 5–7, fig. 5, *a-e*.—STEPHENSEN, 1943. pp. 18–20, fig. 6 (map).
Nymphon mixtum NEEDLER, 1943, p. 7, fig. 6, *a-e*.
Nymphon glaciale NEEDLER, 1943, p. 8, fig. 7, *a-e*.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2062	Aug. 31, 1883	42 17 00	66 37 15	150	
2260	Sept. 28, 1884	40 13 15	69 29 15	46	4
2521	July 12, 1885	42 30 30	65 02 00	65	1
2525	July 13, 1885	41 49 00	65 49 30	72	1
2694	Aug. 11, 1886	46 52 30	44 54 30	86	1
2696	do	46 53 30	46 05 30	98	1
2699	Aug. 22, 1886	45 04 00	55 23 00	72	4

GRAMPUS RECORDS

10013	July 24, 1912	43 16	70 20	----------	1
10019	July 29, 1912	43 30	69 48	45	1
10037	Aug. 21, 1912	44 17	68 05	22	5

ADDITIONAL RECORDS

St. Croix River, between biological station toward Joes Point, St. Andrews, New Brunswick, August 1913, R. W. Miner coll., 7 specimens (AMNH).

Opposite biological station, St. Andrews, New Brunswick, August 1913, R. W. Miner coll., 2 males (1 ov.) (AMNH).

Off Grand Harbor, Grand Manan, August 10, 1910, H. L. Clark and H. B. Bigelow colls., 1 specimen (MCZ).

This ubiquitous circumpolar species is the commonest representative of the genus in New England waters, as it is on the European side of the ocean. It is very variable, especially in the lengths of the tarsal joints and the neck. The shape of the chelae, together with the thick

appearance of the tarsal joints, characterizes this species. Ovigerous males have been collected in New England waters in July. The specimens vary from about 4 to 8 cm. in extent.

Needler, following Giltay, prefers to keep *Nymphon mixtum* [and *N. glaciale*] separate from *N. grossipes*, but Stephensen (1935), working with a large Norwegian series, was unable to separate the varieties. I have had no better success with the New England material at my disposal, consisting of several hundred specimens. As there seems to be no geographical or bathymetric correlation with the various proportions of the lengths of tarsal joints and differences in the palpal joints, at least in the New England region, I see no purpose in trying to maintain these forms, either as distinct species or varieties, although I have allowed the older indentifications to stand in the appendix tables at the end of this paper. Derjugin (1935, pp. 118–122) has an extended discussion in Russian of the *grossipes* complex, and elsewhere in his paper presents a formidable array of graphs and tables. According to his English summary on p. 140, "*Nymphon glaciale*, *N. rubrum* and *N. brevitarse* represent forms of the same species, to which we have left the denomination of *N. brevirostre* . . ." His reasons for using the name *brevirostre* are not explained in the summary, but it seems to me to be an unnecessary addition to the confusion. He goes on to state, in contradiction to his contention that "the species of *N. brevirostre* are easily distinguished from those of the related species," that "all the forms of *N. brevirostre* and *N. grossipes* are characterized by a pronounced variability of the age-character. The different stages of individual development of separate forms may be similar to each other." His concluding statement on this species complex, that "the forms of *N. brevirostre*, *N. grossipes* and *N. mixtum* bear the stamp of geographical and ecological varieties," may hold for the Russian Arctic but evidently breaks down in the Norwegian and New England regions. Until the genus *Nymphon* is revised by someone with access to specimens of all or most of the hundred and more species, and the limits of speciation within this genus are more clearly defined, there will inevitably be some difference of opinion on the status of the forms in the *grossipes* complex in particular.

Distribution.—*Nymphon grossipes* is found in shallow water from the Bay of Fundy to Long Island Sound and in deeper water at various depths to 677 fathoms from Flemish Cap to the southern edge of Georges Bank. It is also known from the Gulf of St. Lawrence, Davis Strait, and northwest Greenland. In European waters it is found from central England to the Arctic Circle and the White Sea. In the North Pacific it occurs as far south as Puget Sound and Japan (lat. 35°N.).

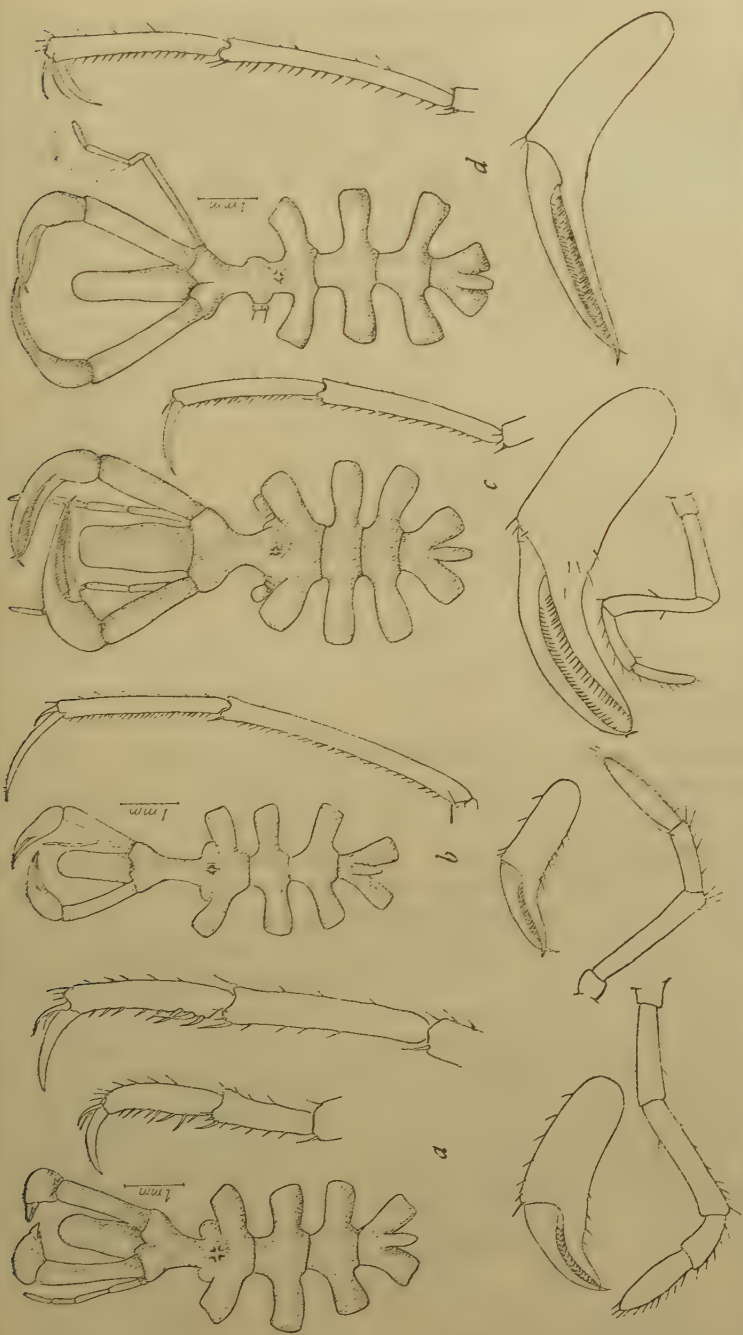

FIGURE 13.—*a*, *Nymphon grossipes* (Fabr.) Krøyer; *b*, *Nymphon longitarse* Krøyer; *c*, *Nymphon strömi* Krøyer; *d*, *Nymphon macrum* Wilson.

NYMPHON LONGITARSE Krøyer

FIGURE 13, *b*

Nymphon longitarse KRØYER, 1844, p. 112.—WILSON, 1878b, p. 19, pl. 7, fig. 2, *a-h*; 1880, pp. 489–491, pl. 6, fig. 30.—SARS, 1891, pp. 75–78, pl. 7, fig. 3, *a-h*.—WHITEAVES, 1901, p. 264.—NORMAN, 1908, pp. 212–213.—STEPHENSEN, 1933, pp. 13–14, fig. 3 (map).—LOSINA-LOSINSKY, 1933, pp. 67–68.—OHSHIMA, 1936, p. 862.—NEEDLER, 1943, p. 9, fig. 9, *a-e*.—STEPHENSEN, 1943, pp. 21–22.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2212	Aug. 22, 1884	39 59 30	70 30 45	428	1
2696	Aug. 11, 1886	46 53 30	46 05 30	98	1

GRAMPUS RECORD

10021	July 29, 1912	43 38 00	69 13 00	60	1

ADDITIONAL RECORD

Sluice at entrance to Kittys Cove and tide rip, St. Andrews, New Brunswick, 3–12 feet, August 25, 1913, R. W. Miner and H. Mueller colls., 1 female (fragments) (AMNH).

A relatively stable and uniform species, for this genus. It is the most delicate and clean limbed of the common New England Nymphons. Ovigerous males have been taken in October.

Distribution.—In the western Atlantic this species is restricted primarily to the Gulf of Maine, where its usual bathymetric range is 16 to 155 fathoms. Stephensen gives Cape Hatteras as the southern limit of its distribution. This appears to be derived from Norman's distribution table of North Atlantic pycnogonids, which consigned our local species to a category titled "N. E. America to 35°." The *Albatross* record from station 2212 is the only known occurrence south of Cape Cod, but it is considerably north of Cape Hatteras. *Nymphon longitarse* has been identified from the Sea of Japan and Peter the Great Bay (1600–1690 meters) by Losina-Losinsky, and from Japanese waters by Ohshima. Hilton (1942a) mentions the species from Alaskan waters. Evidently it is a circumpolar, low Arctic species.

NYMPHON STRÖMI Krøyer

FIGURE 13, *c*

Nymphon strömii KRØYER, 1844, p. 111.
Nymphon giganteum WHITEAVES, 1872, p. 349.—VERRILL, 1874b, p. 411.
Nymphon Strömii WILSON, 1878b, pp. 17–18, pl. 6, fig. 1, *a-h*; 1880, pp. 483–487, pl. 5, pl. 6, fig. 29; 1881, p. 253.—VERRILL, 1885, p. 561.

Nymphon Stroemii WHITEAVES, 1901, p. 263.
Nymphon strömi STEPHENSEN, 1933, pp. 16–17.
Nymphon stroemii NEEDLER, 1943, p. 9, fig. 10, *a-d*.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2046	July 31, 1883	40 02 49	68 49 00	407	1
2062	Aug. 31, 1883	42 17 00	63 37 15	150	2 (1 ov. ♂)
2064	do	42 25 40	66 08 35	122	1
2246	Sept. 26, 1884	39 56 45	70 20 30	122	2
2415	Apr. 11, 1885	30 44 00	79 26 00	440	1
2429	June 23, 1885	42 55 30	50 51 00	471	+15 (incl. ov. ♂♂)
2508	July 8, 1885	44 28 30	62 56 00	72	1 (ov. ♂)
2517	July 12, 1885	43 10 00	64 18 00	55	4
2518	do	43 05 00	64 40 30	60	1
2522	do	42 20 00	65 07 30	104	2
2523	July 13, 1885	41 48 30	65 44 30	111	1
2666	May 5, 1886	30 47 30	79 49 00	270	2
2667	do	30 53 00	79 42 30	273	1
2669	do	31 09 00	79 33 30	352	1
2687	July 18, 1886	39 46 00	71 19 00	326	1
2698	Aug. 22, 1886	45 07 00	55 09 10	90	2
2703	Aug. 23, 1886	44 01 00	59 02 30	140	2
GRAMPUS RECORD					
10019	July 29, 1912	43 30 00	69 48 00	45	1
M. C. Z.					
--------	July 25, 1931	42 16 00	66 34 00	160	6

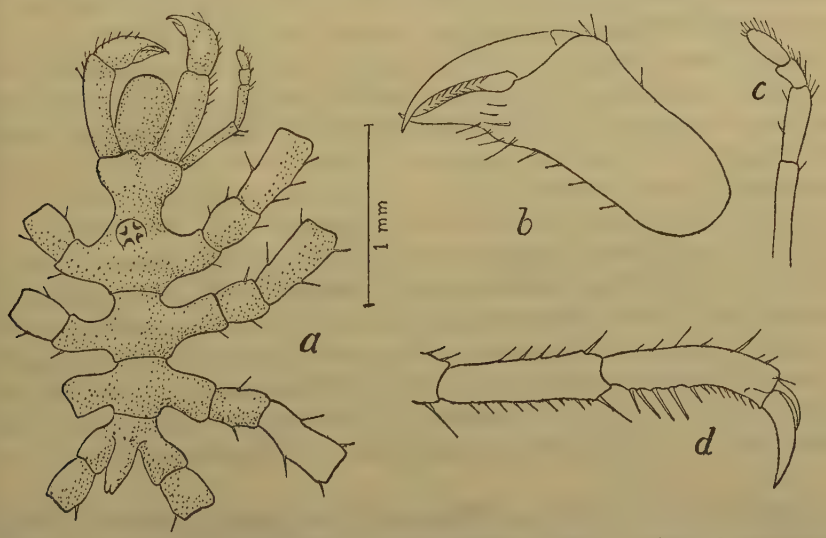

FIGURE 14.—*Nymphon rubrum* Hodge: *a*, Dorsal view; *b*, chela; *c*, palpus; *d*, tarsus and propodus.

This handsome species is the largest local member of the genus. It is usually about 10 cm. in extent, but mature specimens nearly half that size are known.

Distribution.—Primarily a Boreal-Arctic species, occurring as far north as latitude 82° (Stephensen), but it does not appear to be circumpolar, being unknown west of Baffin Bay or from eastern Siberia. But Hilton (1942a) mentions "*Nymphon gracillipes*" from *Albatross* station 3540 (Bering Sea); although *N. gracilipes* is considered a synonym of *N. strömi*, this record is doubtful. *Nymphon strömi* is common in the New England region from 7 to 100 fathoms, but it has been dredged from over 500 fathoms. The *Albatross* records, stations 2666, 2667, and 2669, off South Carolina and Florida, are the southernmost localities for this species.

NYMPHON RUBRUM Hodge

FIGURE 14

Nymphon rubrum HODGE, 1865, p. 41, pl. 10, fig. 1.—SARS, 1891, pp. 58–61, pl. 5, fig. 2, *a–k*.—NORMAN, 1908, pp. 208–209, pl. 29, figs. 4–7.
Nymphon brevirostre HODGE var. *rubrum* DERJUGIN, 1935, pp. 102ff, 140, fig. 16.
Nymphon rubrum STEPHENSEN, 1935, pp. 9–10.—NEEDLER, 1943, p. 11, fig. 13, *a–c*.

This small species was collected by A. H. Leim in Minas Basin, Nova Scotia, on September 8, 1920. There are four somewhat battered specimens in the lot as lent to me by Dr. Alfreda B. Needler and Dr. A. G. Hunstman, of the Fisheries Research Board of Canada. No specimens seem to have been taken by the U. S. Fish Commission during its intensive investigations of the 70's and 80's. Because of its small size it may have been overlooked, but it is probably rare.

Superficially *Nymphon rubrum* looks like a small *grossipes*, but the lateral processes are more widely separated, and the very long, straight spines on the proximal half of the propodus are not found in any forms of *grossipes*. As the name suggests, the creature is red in life. Stephensen considers *rubrum* very close to if not identical with *N. brevirostre* (Hodge), while Derjugin considers it, together with *N. brevitarse*, a variety of *brevirostre*. (See the discussion under *Nymphon grossipes*.) This species is often identified as *N. gracile* Leach, but neither *N. rubrum* nor *N. brevirostre* has the long fourth joint of the palpus which distinguishes *gracile*, a warm-water species found from the southern coast of England to Morocco and the Mediterranean. According to Sars's figures, *N. rubrum* has tufts of setae at the distal ends of the femur and tibiae, but they are not present in the specimens from Nova Scotia.

Distribution.—Norway to Belgium, British Isles to Plymouth, Nova Scotia.

NYMPHON MACRUM Wilson

FIGURES 13, *d;* 15

Nymphon macrum WILSON, 1880, pp. 487–489, pl. 4, figs. 21–23.
Nymphon brevicollum HOEK, 1881, pp. 45–47, pl. 3, figs. 13–15.
Nymphon macrum SARS, 1891, pp. 89–91, pl. 9, fig. 2, *a–g*.
Nymphon brevicollum WHITEAVES, 1901, p. 263.
Nymphon macrum WHITEAVES, 1901, p. 263.
Nymphon brevicollum OLSEN, 1913, pp. 5–6.
Nymphon macrum STEPHENSEN, 1933, pp. 17–18; 1935, pp. 21–22.—OHSHIMA, 1936, p. 862.—HILTON, 1942a, p. 3.—NEEDLER, 1943, p. 10, fig. 11, *a–e*.

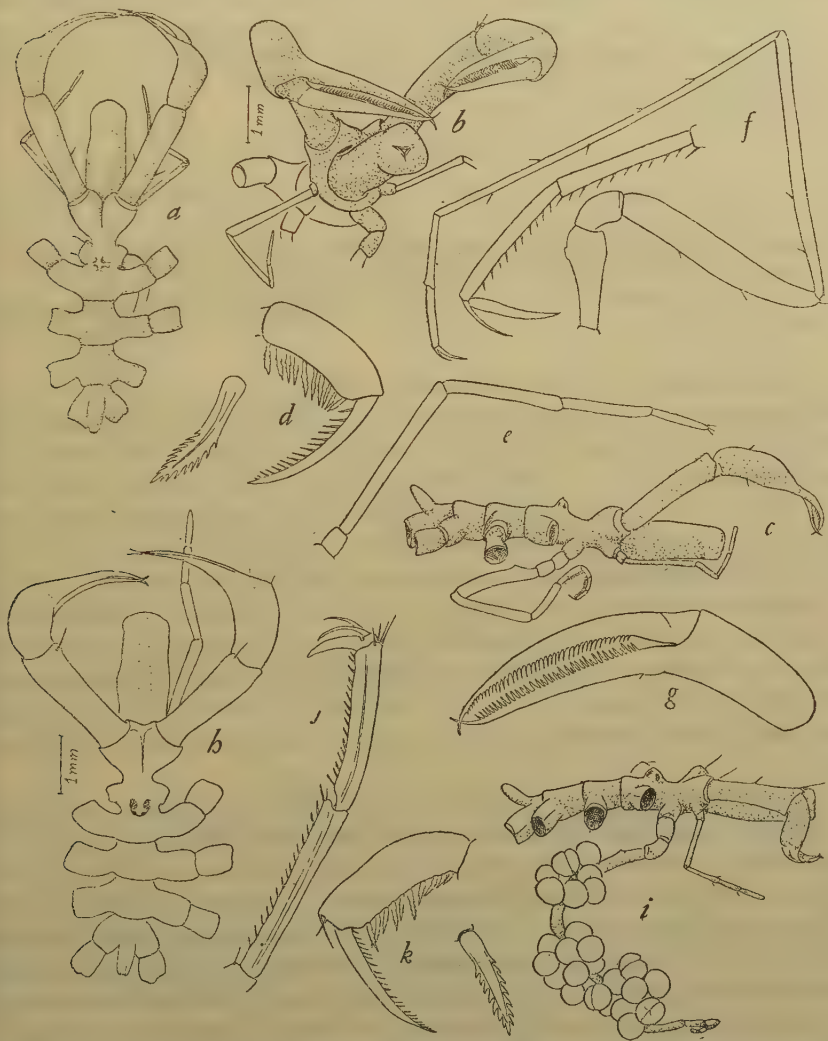

FIGURE 15.—*Nymphon macrum* Wilson, northern form: *a*, Dorsal view of female; *b*, anterior ventral view; *c*, lateral view; *d*, terminal joint of oviger; *e*, palpus; *f*, leg and tarsal joints; *g*, chela. Florida form: *h*, Dorsal view of female; *i*, lateral view of male: *j*. tarsus and propodus; *k*, terminal joint of oviger.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2067	September 1, 1883	42 15 25	65 48 40	122	1
2069	do	41 54 50	65 48 35	101	2
[1] 2071	do	41 56 20	65 48 40	113	2
2115	November 11, 1883	35 49 30	74 34 45	843	1
[2] 2116	do	35 45 23	74 31 25	888	?
2429	June 23, 1885	42 55 30	50 51 00	471	1
2471	July 4, 1885	44 34 00	56 41 45	218	1

[1] This is probably the record given by Stephensen (1933, p. 18): "Collected by the Albatross at 41°50′ N., 65°68′40″ W., abt. 220 m." There is no *Albatross* station for such a position.

[2] *Teste* Hilton; verified by correspondence.

ADDITIONAL RECORDS

Fish Hawk station 7283, lat. 24°17′30″ N., long. 81°53′30″ W., 127 fathoms Feb. 19, 1902, 1 female.

State University of Iowa Bahamas Expedition, between Bahamas and Cuba, 1 male (ov.).

M. C. Z., lat. 42°16′ N., long. 66°34′ W., 160 fathoms, July 25, 1931, W. C. Schroeder coll., 2 females.

This species is somewhat variable in the shape of the neck and separation of the lateral processes. The usual type, as described by Wilson, is illustrated in figure 15, *a–i*. An extreme variety will be found in figure 13, *d*. The type figured by Sars is midway between these extremes. The long chelae with their closely set spinules and the very long auxiliary claws are characteristic of both forms. The two specimens from the Florida region (fig. 15, *h–k*) are too close to *Nymphon macrum* to be considered a separate species in spite of the considerable southern extension in range. The previous record is that by Stephensen (1935), who identified the species from latitude 41°32′ N., longitude 9°5′ W., off Portugal. The principal difference in the Florida type is the heavier tarsal joints and shorter terminal claws.

While this Florida form might be considered a distinct variety of *Nymphon macrum* by some taxonomists, subspecific categories do not seem advisable in a genus whose species are as subject to individual variation as those of this genus. The bewildering array of subspecies, varieties, and forms proposed by certain recent workers may be of some use in emphasizing the degree of variation in their respective species, but their limits are too vaguely defined for taxonomic procedure. It is hard enough to decide what constitutes a species in this genus without adding varieties to the confusion.

Distribution.—A Boreal species, from Massachusetts Bay to the Barents Sea, but sporadically in more southern waters. Ohshima's

Japanese record is a puzzling discrepancy, possibly an error. The bathymetric range of the species in American waters is 35 to 843 fathoms, usually on muddy bottoms.

NYMPHON GILTAYI, new species

FIGURE 16

Types.—Holotype (male): U.S.N.M. No. 37912, Gloucester Donation 360, 1879, schooner *Conductor*, Capt. George H. Curtis (probably from Grand Bank). Paratype (female): U.S.N.M. No. 37912, same locality.

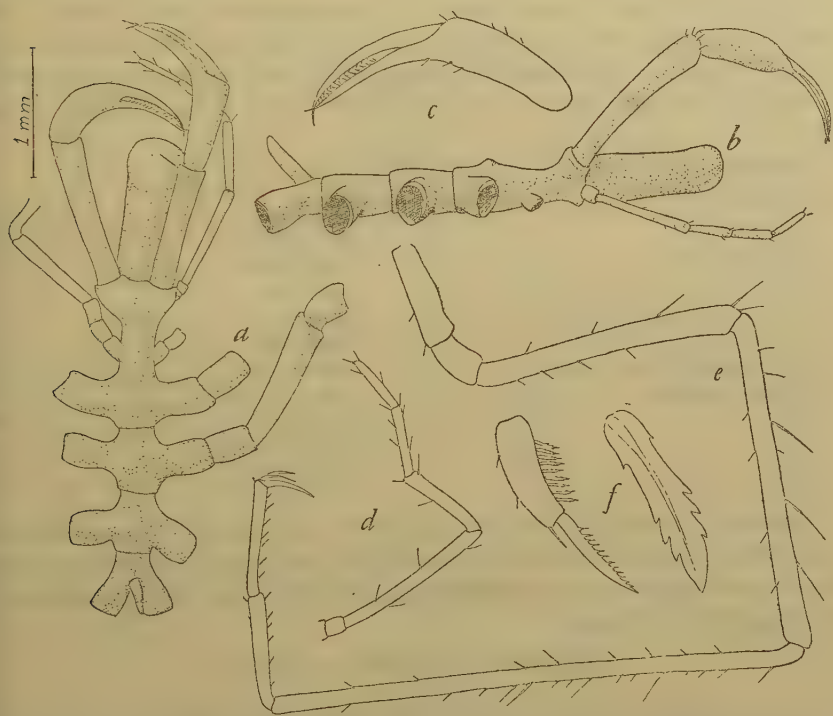

FIGURE 16.—*Nymphon giltayi*, new species: *a*, Dorsal view; *b*, lateral view; *c*, chela; *d*, palpus; *e*, leg; *f*, terminal joint of oviger and denticulate spine.

Description.—Trunk: Lateral processes separated by their own width. Cephalic segment a little longer than proboscis, neck long, ovigers based near the middle. Eye tubercle very low, without eyes.

Proboscis cylindrical, constricted slightly at about its proximal third.

Abdomen short, slightly longer than last lateral processes, directed upward at an angle of about 50°.

Palpus slender, longer than proboscis. Second segment longest, longer than third and fourth segments, which are subequal. Last segment slightly shorter than fourth.

Chelifore: Scape about one-fifth longer than proboscis. Chelae about as long as scape, palm slender, subequal to fingers. Fingers curved, each with about 15 spinules.

Oviger: Fourth and fifth segments about equal, nearly straight and slightly swollen distally. Terminal spine as long as tenth segment, with 12 short, evenly spaced teeth on its distal three-fourths. Denticulate spines rather broad, with about three large broad denticulations. Spine formula: 17:12:9:9.

Leg slender, armed with scattered setae, some of them about three times as long as the diameter of the leg segments. Tarsus and propodus subequal. Auxiliary claws at least half as long as terminal claw. The spines on the propodus are widely spaced and of even size.

Measurements (holotype) as follows:

Proboscis:	*Mm.*	Leg (detached):	*Mm.*
Length	1. 1	First coxa	0. 35
Diameter	0. 3	Second coxa	0. 8
Trunk, length	2. 25	Third coxa	0. 4
Cephalic segment, length	1. 1	Femur	2. 0
Base of chelifores, width	0. 6	First tibia	2. 5
Second lateral process, width	2. 1	Second tibia	4. 0
Abdomen, length	0. 25	Tarsus	0. 8
		Propodus	0. 8
		Terminal claw	0. 4
		Auxiliary claw	0. 25

Remarks.—Except for the long setae on the legs and the absence of eyes, this species resembles *N. macrum*. The chela is smaller and the fingers are armed with comparatively few spinules. Both specimens are somewhat damaged.

NYMPHON FLORIDANUM, new species

FIGURE 17

Nymphon sp. COLE, 1910, p. 196.

Types.—Holotype (male): U. S. N. M. No. 81093, 5 miles south of Loggerhead Key, Tortugas, Fla., 7–10 fathoms, July 20, 1924, W. L. Schmitt coll. (station 32). Paratype (female): U. S. N. M. No. 81093, same locality.

Additional specimens.—As follows, all from Tortugas, Fla.:

1 specimen (fragments); surface tow; April 14, 1906; Leon J. Cole, coll.

1 female; surface tow, attached to floating algae; April 9, 1906, Leon J. Cole, coll.

1 female (recently spawned); surface tow; April 19, 1906; Leon J. Cole, coll.

1 specimen (incomplete); surface tow; April 21, 1906; Leon J. Cole, coll.
1 male; surface tow; April 22, 1906; Leon J. Cole, coll.
1 female; White Shoal; July 19, 1924; W. L. Schmitt, coll.

Description.—Trunk: Lateral processes separated by slightly more than half their own width. Neck variable in length, from as long as the third and fourth trunk segments to half that length. Ovigers based in front of first pair of legs. Eye tubercle bluntly conical, eyes large.

Proboscis roughly cylindrical, constricted near the tip.

Abdomen about as long as last lateral process, directed upward at an angle of about 60°.

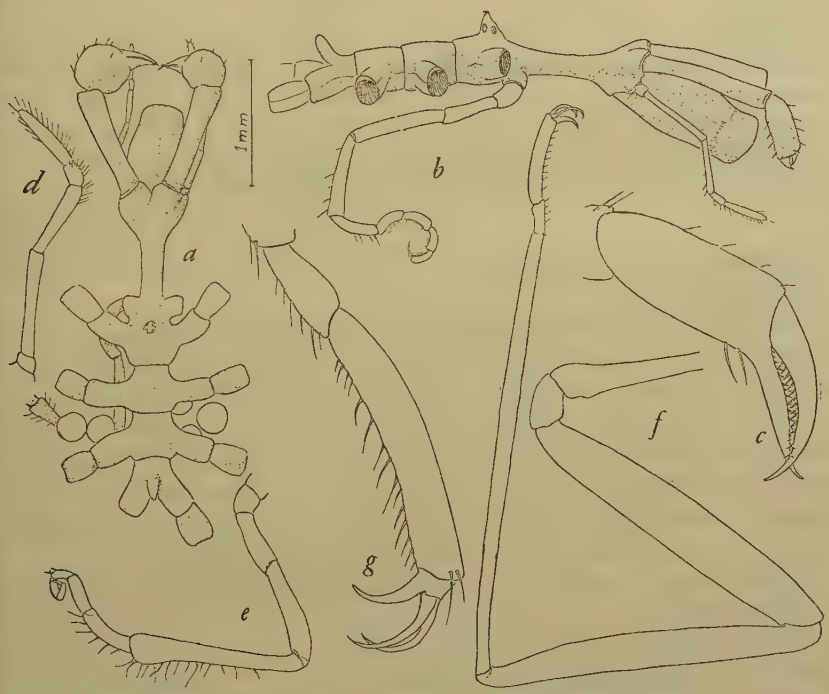

FIGURE 17.—*Nymphon floridanum*, new species: *a*, Dorsal view of holotype; *b*, lateral view of paratype; *c*, chela; *d*, palpus; *e*, oviger of male; *f*, leg; *g*, tarsus and propodus.

Palpus slender, the second joint longest, third and fourth joints subequal and slightly shorter than second. Fourth joint not much longer than wide. There are a few setae on the ventral distal end of the third joint, the ventral margin of the fourth, and on most of the fifth.

Chelifore: Scape slender, about as long as the proboscis. Chela large, fingers about as long as palm, crossed at tip, each with about 15 spinules.

Oviger: Third segment half as long as fourth, fourth half to two-thirds as long as fifth. Fifth segment straight, swollen distally, with slender curved setae on the ventrodistal half. Eggs large, about 0.25 mm. in diameter. Terminal spine as long as terminal segment, without denticulations. Spines on terminal segments apparently without denticulations. Spine formula: 9:9:7: 6.

Leg: Slender, femur and first tibia equal, second tibia about half again as long. Tarsus less than one-third as long as propodus. Propodus slightly curved, with a row of well-separated, slender spines on the sole. Auxiliary claws as long as terminal claw.

Measurements (holotype) as follows:

Proboscis:	*Mm.*	Third leg:	*Mm.*
Length	1. 0	First coxa	0. 5
Diameter	0. 5	Second coxa	1. 2
Trunk, length	2. 5	Third coxa	0. 4
Cephalic segment, length	1. 5	Femur	2. 5
Base of chelifores, width	0. 6	First tibia	2. 5
Second lateral process, width	1. 0	Second tibia	3. 5
Abdomen, length	0. 25	Tarsus	0. 2
		Propodus	0. 75
		Claws	ca. 0. 18

Distribution.—This species is so far known only from the Florida Keys region.

Remarks.—Most of Cole's tow-net material (some of it collected by Mayer, but not so indicated on the labels) varies from the specimens selected as types in that the neck is about half as long. All the specimens agree, however, in the proportions of the tarsal joints, triangulate appearance of the terminal claws, and proportions of the palpal joints. This combination of characters, together with the untoothed terminal claw of the oviger, makes this an easy species to identify. It appears to have no near relatives in the warm Atlantic area.

The European ecological counterpart of *Nymphon floridanum* is *Nymphon gracile* Leach (non *gracile* Sars, 1891, pp. 55–58, pl. 5, fig. 1, *a–h*, which=*Nymphon brevirostre* (Hodge), which in turn is "extremely difficult if not impossible to distinguish" from *N. rubrum* Hodge, according to Stephensen, 1935, p. 9). *Nymphon gracile* has been collected by surface tows at night in considerable numbers (+150 individuals) during its breeding season from January to April at Banyuls-sur-Mer by Fage (1932). One of the specimens of *floridanum* collected by Cole in April (probably in daytime) is a female that had recently discharged its eggs.

Nymphon gracile in not a very close taxonomic relative of *N. floridanum*, however. The tarsal joints of *gracile* are subequal, with a few large spines on the sole of the propodus, the auxiliary claws are half as long as the terminal claw, and the proportions of the palpal joints are conspicuously different. The fourth joint of the palp of

gracile is nearly as long as the third. *N. gracile* is known from the coast of Denmark to the Atlantic coast of Morocco and in the Mediterranean (Bouvier, 1923, pp. 30–31, fig. 24), where it appears to be the only species of *Nymphon*. Bouvier (1923, p. 31) suggests that *N. cienfuegosi* Franganillo (1918) is probably *gracile*. Hilton's record (1942a, p. 7) of *Nymphon gracile* from Alaskan waters appears to be an error for *N. brevitarse* Krøyer, which is understandable in view of the confusion in nomenclature (Hedgpeth, 1943a, p. 89).

Family PALLENIDAE Wilson, 1878

Phoxichilidae Norman, 1908, p. 231.
Pallenidae Marcus, 1940b, p. 21.
Callipallenidae Hilton, 1942b, p. 281. (*Nec* "Callipallenidae (Hoek) 1876"!)

Chelifores present, usually with small chelae; scape 1- or 2-jointed. Palpi usually lacking or represented by rudimentary knobs near the base of the proboscis. Ovigers 10-jointed, with or without a terminal claw, present in both sexes. There are certain species of dubious standing, e. g., "*Pallene palpida*" Hilton (1939, p. 30) and *Oropallene dimorpha* (Hoek, 1898, p. 290), in which the palpus is 4-jointed in the male.

Certain changes in generic names in this family have been proposed that are, to say the least, confusing. Not only do they tax the patience of taxonomists by defeating the purpose of the international rules of nomenclature by an overzealous adherence to them, but also they threaten to turn future synonymies into an inextricable tangle, which would make it impossible for anyone but a specialist to know the precise species under discussion in general or ecological papers.[17]

It all began in 1902 when the Rev. T. R. R. Stebbing published, in an otherwise admirable series of popular articles entitled "The Nobodies, a Seafaring Family," some recommended changes in nomenclature. He proposed *Chilophoxus* as a generic name to supplant the familiar *Phoxichilus* (now known as *Endeis*), then in general use. The *Phoxichilus* of Latreille was really the same as Wilson's *Pseudopallene;* hence the latter name should be discarded in favor of *Phoxichilus* Latreille and the family name Pallenidae be changed to Phoxichilidae.

This argument was taken up and elaborated by Norman (1908), who satisfied himself that *Phoxichilus* auct. nec Latreille and *Chilophoxus* Stebbing were congeneric with *Endeis* Philippi. Norman cited Latreille's (1804, vol. 24, p. 137) original diagnosis, which was vague enough even to apply to *Colossendeis*, although he did refer *Pycnogonum spinipes* O. Fabricius to his *Phoxichilus*. This incorrect diagnosis was elaborated in later editions of Latreille's work, with the further suggestion that *Nymphon femoratum* Rathke and possibly

[17] See Cole's (1910, p. 194) unhappy footnote.

Phalangium spinosum Montagu also belonged to the genus. It is quite obvious that Latreille had no clear idea of generic characters in the Pycnogonida, for these three species belong to widely separated genera. At any rate, *Phoxichilus* Latreille (Stebbing, and Norman) has not been formally accepted in place of *Pseudopallene* Wilson by subsequent workers, although Marcus (1940b, p. 128) advocates its use.[18]

This affair inspired some eloquent objections at the height of the controversy (Loman, 1915; Bouvier, 1917). Certainly the delight that some taxonomists find in resurrecting these desiccated museum names—"ces exercises byzantins!" as Bouvier (1923, p. 3) called it—is not the most praiseworthy occupation with which they might busy themselves. One cannot resist quoting Loman's (1915, pp. 211–216) sentiments: "Et avec un soupir de soulagement ces mots nous échappent: Dieu, merci, enfin, nous y sommes. C'est arrêté."

But Loman sighed for relief too soon, and it was no less a person than Bouvier who, despite his jibes at his fellow taxonomists for their exotic diversions (if one may thus freely paraphrase "exercises byzantins"), contributed the ultimate complication to this tangled tale of generic names. Although he had suggested, in 1917 (p. 29), that he had seen a specimen labeled by Latreille himself as "Phoxychile phalangioides," which was actually a *Pallenopsis*, his information was greeted by a tacit conspiracy of silence. Perhaps no one took him seriously, but finally, in his last paper on the Pycnogonida (1937), Bouvier described this specimen under Latreille's manuscript name *Phoxichilus phalangioides*, suggesting at the same time that it should be considered the genotype and that therefore *Pallenopsis* should be discarded in favor of *Phoxichilus*. This is too much. In the first place, the existence of a named but hitherto undescribed species does not establish that specimen as a genotype, and such sedulous adherence to priority, while it may be a commendable gesture of respect and patriotism by one Frenchman to another, does no service to orderly procedure. Inasmuch as *Pseudopallene spinipes* seems to have been the first species formally referred by Latreille to his genus, it is the genotype by designation, and this *Pallenopsis* identification is simply another demonstration of his foggy conception of what constituted a genus in the Pycnogonida. In the second place, *Phoxichilus* is already a worn-out name, having been confused with two other genera, and to use it for a third genus, previously unsullied by such questionable synonymy, is confounding the confusion. Whatever the arbitrary rules may be, they are not immutable laws, and it would seem

[18] There has been no work on Arctic and European pycnogonids by English authors since Norman's day until Lebour's recent paper (1945). There were a few lists by Carpenter, in one of which (1912, p. 4) he suggested that "*Phoxichilus* had better be dropped altogether." I have already done this, in a previous paper (1943a, p. 88).

wisest to discard both *Phoxichilus* and its unlovely anagram, *Chilophoxus*, altogether, retaining in their stead the names that have been most consistently associated with these forms, at least in the past 40 years, namely, *Endeis*, *Pseudopallene*, and *Pallenopsis*.

As for Latreille's species, while it cannot be assigned to his name as Bouvier tried to do by citing it as *Phoxichilus phalangioides* Latreille (Bouvier), it appears to be a good species, although its general appearance suggests *Pallenopsis denticulata* Hedgpeth (1944) from Western Australia. Its origin is something of a mystery, however, as few members of the genus have been taken from shallow water, and natural-history dredging was practically unknown in Latreille's day. If it is a North Atlantic form, it has yet to be retaken. No species of *Pallenopsis* has been found near the European coast, with the exception of *P. tritonis* Hoek, off the Irish coast, which is a deep-water form.

The proposal to scrap Pallenidae (or Callipallenidae) in favor of Phoxichilidae, whatever the merits of the *Phoxichilus-Pseudopallene-Pallenopsis* controversy may be, is unnecessary and is not required by any rule of nomenclature. As Schenk and McMasters [19] remark, the selection of the first-named genus in a family for the genotype is unsound and has many disadvantages. In this case these disadvantages are obvious: not only are we none too sure of the exact status of Latreille's *Phoxichilus*, but the family name Phoxichilidiidae Sars is so similar that confusion is inevitable unless the name is written "Phoxichilidae (Pallenidae)" as has been done by Calman (1914a) and Gordon (1932).

That Pallenidae should be retained in favor of Callipallenidae (the type genus *Pallene* is a preoccupied name) is another matter; with Marcus (1940b) I agree that Pallenidae can be retained in spite of this change. It is the most appropriate name for a family in which so many generic names are some compound of the original *Pallene:* e. g., *Parapallane*, *Pseudopallene*, *Austropallene*, *Pallenopsis*.

Fortunately the troublesome, ambiguous genera in this family need not concern us here; four genera are known from American waters, and they can be separated on the basis of the characters in the following key:

1. Chelifores usually 2-jointed (sometimes 3-, but with oval trunk); not based on a conspicuous extension over proboscis; without rudimentary palpi 2
   Chelifores 2- or 3-jointed, based on an extension over proboscis; palpi present as rudimentary knobs ..... **Pallenopsis** (p. 209)
2. Without auxiliary claws; legs often heavy and knobby; or, with large globular chelae 3
   Auxiliary claws present; legs not knobby; chelae small ..... **Callipallene** (p. 202)

[19] Procedure in taxonomy, p. 7. Stanford University, 1936.

3. Chelifores 2-jointed; body extended or disciform but not oval 4
   Chelifores 3-jointed; body compact, oval as in *Pycnogonum*.
   Pigrogromitus (p. 214)
4. Without setose fringe (or apparently raised rim) around mouth; chelae globular ..... **Cordylochele** (p. 206)
   With setose fringe around mouth; local forms with prominent spiny processes on trunk and legs ..... **Pseudopallene** (p. 205)

Genus CALLIPALLENE Flynn, 1929

(pro *Pallene* Johnston, 1837)

Chelifore 2-jointed, chelate, opposed in front of proboscis. Oviger 10-jointed, with spines on terminal joints. Propodus without large basal spines, auxiliary claws usually present. Trunk elongate, last two segments often coalesced, cephalic segment prolonged into a neck.

Four species of this characteristic genus have been identified from western Atlantic waters. One of them is a deep-water species, while the other three have all been taken in surface tows at one time or another. Key to the species represented:

1. Eye tubercle low, broad, eyes present 2
   Eye tubercle tall, pointed, without eyes ..... **acus** (p. 204)
2. Neck longer than wide 3
   Neck shorter than wide ..... **emaciata** (p. 204)
3. Propodus short, basal spines short, curved ..... **brevirostris** (p. 202)
   Propodus slender, long, basal spines long, straight ..... **phantoma** (p. 204)

CALLIPALLENE BREVIROSTRIS (Johnston)

FIGURE 18, *a*

Pallene brevirostris JOHNSTON, 1837, p. 380, pl. 12, figs. 7, 8.
Pallene sp. VERRILL, 1873b, p. 415.
Pallene empusa WILSON, 1878b, p. 9, pl. 3, fig. 2, a–g; 1880, pp. 476–477, pl. 2, figs. 5–7.—RATHBUN, 1881, p. 118.—MORGAN, 1891, pp. 8–22 (embryology).
Pallene brevirostris COLE, 1901, pp. 195–207 (habits).—SUMNER, OSBURN, and COLE, 1913, p. 677.—FISH, 1925, p. 161.

RECORD OF COLLECTIONS

Bay of Fundy, 1872, 1 specimen (Y.P.M. No. 4780).

Buzzards Bay, Woods Hole, Mass., July 21, 1909, 3 fathoms, F. B. Sumner, R. C. Osburn, and R. W. Miner colls., 1 male (AMNH).

Entrance to Lagoon Pond, Vineyard Haven, Mass., July 27, 1910, on piles under bridge, R. W. Miner and H. Hall colls., 1 male (ov.), 1 female (AMNH).

Fish Hawk station 8821, off Sandy Point, Chesapeake Bay, July 8, 1920, 2 specimens.

Fish Hawk station 8898, off Thimble Rock, Chesapeake Bay, 28.08 fathoms, December 4, 1920, 3 specimens.

This is the smallest species of pycnogonid from the Woods Hole region. Although it is somewhat larger in extent than *Tanystylum orbiculare*, its body is smaller and the legs are so delicate that the animal looks smaller than it actually is.

Callipallene brevirostris is one of the permanent members of the fauna of the Woods Hole region, although it was apparently not so

common at the time of the biological survey by Sumner, Osburn, and Cole as it was when Morgan studied its embryology there in 1890, or later, when Fish found it almost daily in his surface tows during July and August. In addition to Rathbun's record from Provincetown, Cape Cod, there is the above record from the Bay of Fundy, extending the range of this species to Boreal waters. It does not seem to have been collected from that locality since and the record must be accepted with reservations; it may be a misplaced label.

Distribution.—European littoral, from southwestern Norway to the Mediterranean. Atlantic coast of North America, from Woods Hole southward. There is a specimen in the Woods Hole Oceanographic fouling collection from station H4, off entrance to Tampa Bay, 34 feet, July 19, 1943, indicating the occurrence of this species at least as far south as Florida.

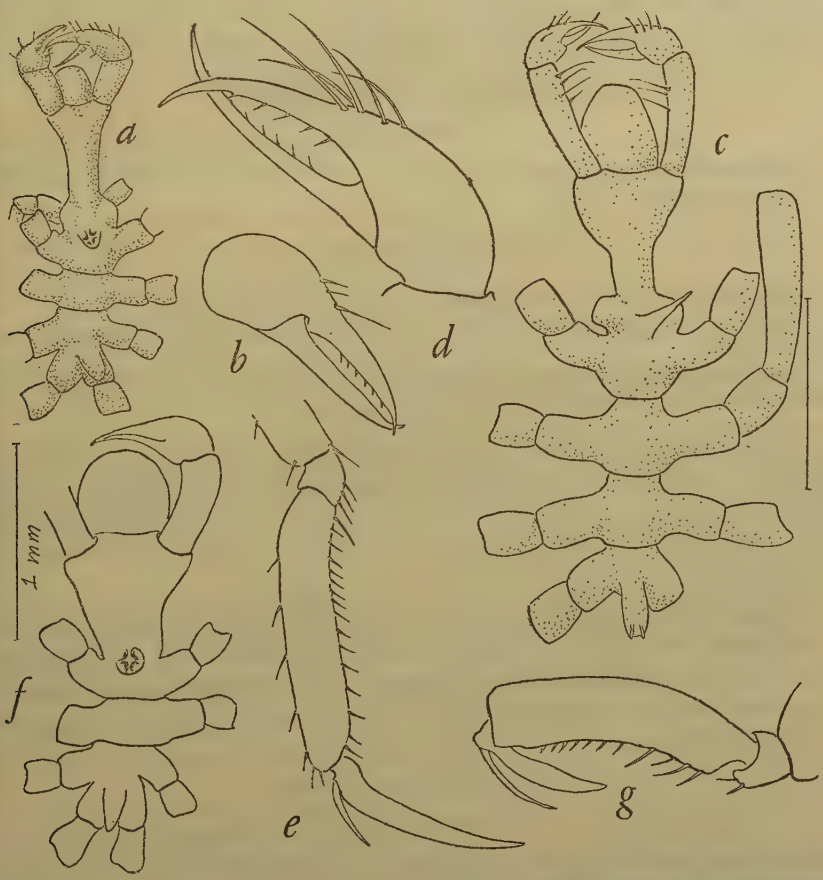

FIGURE 18.—*a*, *Callipallene brevirostris* (Johnston); *b*, *Callipallene phantoma* (Dohrn); *c–e*, *Callipallene acus* (Meinert); *f*, *g*, *Callipallene emaciata* (Dohrn).

CALLIPALLENE PHANTOMA (Dohrn)

FIGURE 18, *b*

Pallene phantoma DOHRN, 1881, p. 196, pl. 14, figs. 1–9.
Pallene producta SARS, 1891, pp. 36–37, pl. 3, fig. 2, a–d.
Pallene phantoma GILTAY, 1934c, pp. 1–5, fig. 1 (synonymy).

RECORD OF COLLECTIONS

Off Bird Key, Fla., surface tow, April 17, 1906, Leon J. Cole coll., 1 female (incomplete).

The single specimen is sadly battered but easily identifiable from the straight propodus with its four long, straight, basal spines. The surface-tow record is of interest, as the specimen appears to be a recently spawned female.

Giltay gives a complete synonymy and a distribution table (p. 4), indicating the occurrence of this species from Trondheim, Norway, to the Azores, and in the Gulf of Naples and the Black Sea.

CALLIPALLENE EMACIATA (Dohrn)

FIGURE 18, *f*, *g*

Pallene emaciata DOHRN, 1881, pp. 193–195, pl. 14, figs. 10–21.—BOUVIER, 1923, p. 36, fig. 29.

RECORD OF COLLECTIONS

Key West, Fla., April 15–27, 1884, 1 specimen (fragments).

Tortugas, Fla., surface tow, April 21, 1906, Leon J. Cole coll., 1 specimen (fragments).

Loggerhead Key, Tortugas, Fla., from algae and old coral rocks, 4 feet, July 14, 1926, C. R. Shoemaker coll., 1 specimen (fragments).

Unfortunately all three specimens are in a fragmentary condition, and their reference to this species is made with some hesitation. The specimens agree with Dohrn's figures, however, and the distribution, i. e., Naples and the Caribbean, is consistent with that of several other species.

Schimkewitsch (1930, p. 245) suggests that this species is synonymous with *Callipallene brevirostris*, and Bouvier (1923, p. 36) states that the two appear to be the same. This implies a considerable range in body proportions which is not evident in the inadequate material before me.

CALLIPALLENE ACUS (Meinert)

FIGURE 18, *c–e*

Pallene acus MEINERT, 1899, pp. 48–49, pl. 4, figs. 8–13.
Pallene hastata MEINERT, 1899, p. 49, pl. 4, figs. 14–19.
Pallene acus BOUVIER, 1917, pp. 26–27, pl. 3, fig. 7.—STEPHENSEN, 1933, p. 20.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2078	Sept. 4, 1883	41 11 30	66 12 20	499	1♂, 1♀
2571	Sept. 1, 1885	40 09 30	67 09 00	1,356	1♂ (ov.)

The form and size of the propodus and terminal claws in these specimens are intermediate between Meinert's figures for *C. acus* and *C. hastata*, supporting Bouvier's conclusion that the species are synonymous.

Distribution.—Evidently a species of the North Atlantic Basin, but infrequently collected. The previous records are Meinert's from Davis Strait and Bouvier's from west of the Azores. The *Albatross* collections are just off the continental shelf southeast of Cape Cod. The bathymetric range, from this scant material, is 499–1,435 fathoms.

Genus PSEUDOPALLENE Wilson, 1878

?*Phoxichilus* Latreille, 1804, p. 137.
Pseudopallene Flynn, 1928, p. 23.

Chelifore 2-jointed, chela usually heavy. Palpus absent. Legs spiny, without auxiliary claws. Oviger 10-jointed. Body usually compact; mouth with a fringe of setae.

A small genus; four, perhaps six, species have been referred to it so far. *Pseudopallene circularis* and *P. spinipes* are widely distributed Boreal-Arctic species, *P. pachycheira* is from the coast of New South Wales, and *P. gilchristi* is a South African species. *Pseudopallene circularis* is the only species known from American waters (New England region), but *P. spinipes* might turn up in future collections off Newfoundland. It is not uncommon at Cape Farewell. Hilton (1942c, p. 39) mentions two Alaskan species, *Pseudopallene setosa* and *P. spinosa*, which may prove to be synonyms of *P. circularis* in view of the wide range of variation recognized for that species. The characters mentioned are inadequate for including the species in the key.

KEY TO THE SPECIES (AFTER FLYNN, 1928)

1. Lateral processes close 2
   Lateral processes separated by more than their own diameter. ..... **gilchristi** Flynn
2. No dorsal tubercles on trunk 3
   Dorsal spines and tubercles present ..... **circularis** (p. 206)
3. Scape longer than proboscis ..... **spinipes** (O. Fabricius)
   Scape equal to or shorter than proboscis ..... **pachycheira** Haswell

PSEUDOPALLENE CIRCULARIS (Goodsir)

FIGURE 19

Pallene circularis GOODSIR, 1842, p. 136, pl. 3.
Pallene hispida STIMPSON, 1853, p. 37.
Pseudopallene hispida WILSON, 1878a, p. 200; 1878b, p. 10, pl. 3, fig. 1, a–e.
Pseudopallene discoidea WILSON, 1878b, p. 12, pl. 3, fig. 3, a–c.
Pseudopallene hispida WILSON, 1880, pp. 478–479, pl. 2, fig. 9.
Pseudopallene discoidea WILSON, 1880, pp. 479–480, pl. 2, fig. 10.
Pseudopallene circularis SARS, 1891, pp. 38–42, pl. 3, fig. 3, a–h.
Pseudopallene hispida WHITEAVES, 1901, p. 263.
Phoxichilus circularis NORMAN, 1908, p. 207.
Pseudopallene circularis STEPHENSEN, 1933, pp. 20–21.—NEEDLER, 1943, p. 12, fig. 15, a–d.

RECORD OF COLLECTIONS

Grampus station 10037, lat. 44°17′ N., long. 68°05′ W., off Frenchmans Bay; July 21, 1912, 22 fathoms, 2 specimens.

The number and position of the spines on the dorsum of the trunk and the shape of the chelae are variable in this species. Specimens from Grand Manan and Eastport are about half the size of those from northwest Greenland. It is not common in the New England region and is unknown south of Cape Cod.

FIGURE 19.—*Pseudopallene circularis* (Goodsir).

Distribution.—A Boreal-Arctic species, from Okhotsk Sea to Northeastern America, perhaps circumpolar.

Genus CORDYLOCHELE Sars, 1888

Chelifore 2-jointed, chelae heavy, almost globular. Trunk completely segmented, elongate, lateral processes well segmented. Ovigers 10-jointed. Without auxiliary claws.

Three, possibly five, species are included in this genus. *Cordylochele malleolata*, *longicollis*, and *brevicollis* are the species from the North Atlantic. *C. malleolata* and *brevicollis* are very similar, but in *brevicollis* the body is thicker and more compact, and the chelae are not quite so massive as in *malleolata*. *C. brevicollis* is an Arctic species and is not represented in the collections from American waters. Hilton (1942c, pp. 39–40) has published preliminary diagnoses for

two species from the Bering Sea. One of these, *C. setospinosa*, appears to be well characterized by spines and setae on the trunk and legs.

The western Atlantic species can be separated by the following characters:

1. Neck short; lateral processes separated by less than their own diameter. **malleolata** (p. 207)

   Neck long as last three trunk segments; lateral processes separated by more than their diameter **longicollis** (p. 207)

CORDYLOCHELE MALLEOLATA (Sars)

FIGURE 20, *a*

Pallene malleolata SARS, 1879, No. 48.
Cordylochele malleolata SARS, 1891, pp. 45–49, pl. 4, fig. 1, *a–k*.—STEPHENSEN, 1933, p. 25.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2428	June 23, 1885	42 48 00	50 55 30	826	1
2429	do	42 55 30	50 51 00	471	+10
2471	July 4, 1885	44 34 00	56 41 45	218	+5 (inc. ov. ♂♂)
2528	July 13, 1885	41 47 00	65 37 30	677	1

A Boreal-Arctic species from moderate depths; the bathymetric range of the stations above, 218–826 fathoms, extends the known range in both directions.

Distribution.—Cordylochele malleolata is previously known from the waters around Iceland, Spitsbergen, and the Faroes, and in the Kara Sea. Westward it occurs in the Denmark and Davis Straits to latitude 66°35′ N. These are the first records from the American side of the Atlantic.

CORDYLOCHELE LONGICOLLIS Sars

FIGURE 20, *b*

Cordylochele longicollis SARS, 1888, No. 12; 1891, pp. 49–51, pl. 4, fig. 2, *a–g*.—STEPHENSEN, 1933, pp. 25–26.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2666	May 5, 1886	30 47 30	79 49 00	270	1
2667	do	30 53 00	79 42 30	273	2

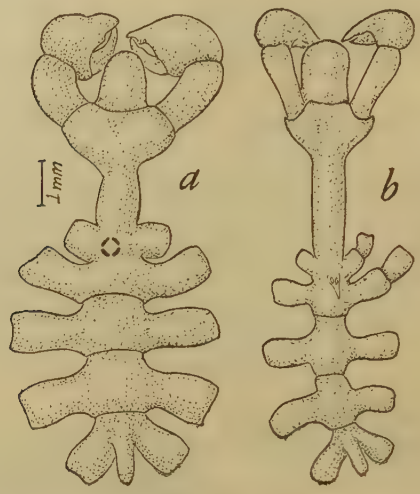

FIGURE 20.—*a*, *Cordylochele malleolata* (Sars); *b*, *Cordylochele longicollis* Sars.

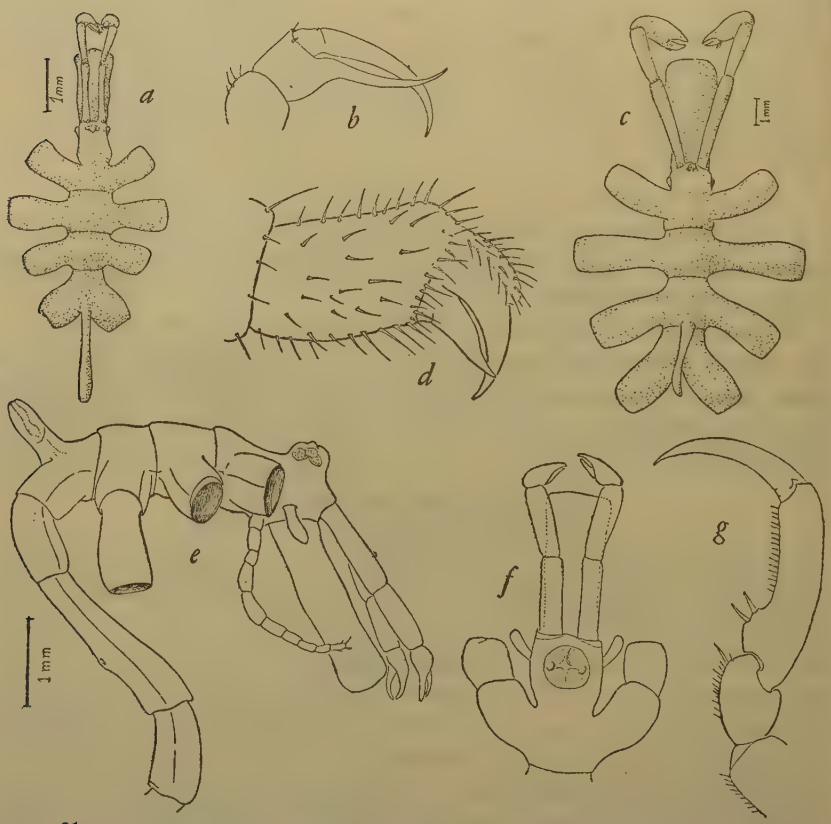

FIGURE 21.—*a*, *b*, *Pallenopsis longirostris* Wilson; *c*, *d*, *Pallenopsis forficifer* Wilson; *e*–*g*, *Pallenopsis calcanea* Stephensen.

These records represent a considerable southern extension of the known range of this species.[20] It occurs in the north Atlantic south of the Wyville Thomson Ridge and in Davis Strait.

Genus PALLENOPSIS Wilson, 1881

Pallenopsis Wilson, 1881, p. 250.—Loman, 1916, pp. 15–25.—Calman, 1923, p. 281 (key).
Phoxichilus Bouvier, 1937, pp. 3–11.
Pallenopsis Marcus, 1940a, pp. 181–182.

Chelifores 2- or 3-jointed, chelae small. Palpi present as minute knobs or small papillae. Oviger 10-jointed, without terminal claw, present in both sexes, but reduced in the female. Trunk elongate, legs long, slender, propodus well developed, usually with auxiliary claws and basal spines.

There are more than 30 species in this genus, many of them separated by minor characters. Fortunately there are not many species known from north Atlantic waters. Three species are included in the fauna of the waters adjacent to the United States, and a fourth, *Pallenopsis calcanea*, has been found off Labrador and Bermuda.

1. Propodus without a well-developed heel, auxiliary claws present 2
   Propodus with a prominent heel with two basal spines, auxiliary claws lacking ..... **calcanea** (p. 211)
2. Fingers of chelae shorter than palm, wedge-shaped 3
   Fingers of chelae longer than palm, slender, bowed, and crossing at tips. **longirostris** (p. 210)

   [Proboscis somewhat smaller at tip (not slightly expanded as in *longirostris*); fingers of chelae curved about as long as palm (eastern Atlantic, near British Isles) ..... *tritonis* Hoek]
3. Lateral processes about twice as long as their diameter; chelae with a prominent spiny cushion at base of dactylus ..... **forficifer** (p. 209)
   Lateral processes not much longer than their diameter, widely separated; spiny cushion on chelae very low, inconspicuous ..... **schmitti** (p. 212)

PALLENOPSIS FORFICIFER Wilson

Figure 21, *c*, *d*

Pallenopsis forficifer Wilson, 1881, pp. 250, 252, pl. 4, figs. 15–18, pl. 5, fig. 23.—Hedgpeth, 1943b, p. 43.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2666	May 5, 1886	30 47 30	79 49 00	270	4
2667	do	30 53 00	79 42 30	273	5
2668	do	30 58 30	79 38 30	294	4
2669	do	31 09 00	79 33 30	352	3

[20] Stephensen (1933, p. 6), mentions a specimen in the Zoological Museum of Copenhagen from "off E. America abt. 37° N," which is probably from *Albatross* material, but I could find no record of it. Selections from a number of *Albatross* lots were sent to Meinert at some time or another.

FISH HAWK RECORD

7285	Feb. 19, 1902	24 15 00	81 47 30	306	1

UNIVERSITY OF IOWA BAHAMAS EXPEDITION

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
56	June 27, 1893	24 16 00	81 22 00	200	1
62	June 29, 1893	Off American Shoal Light		70–80	1 ♂ (ov.), 1 ♀

This species can be distinguished by the prominent spiny cushion on the chelae and the long lateral processes, which are splayed out so that they are more widely separated distally than at their origin. The propodus is rather long, and the basal spines are irregular in size and location. The articulation of the scape is very indistinct in many specimens.

Distribution.—Restricted to the warm waters south of Cape Hatteras and in the Caribbean, from 200 to 352 fathoms. The northernmost record is that given by Wilson: *Blake* station 318, lat. 32°25′ N., long. 77°42′30″ W., 262 fathoms.

PALLENOPSIS LONGIROSTRIS Wilson

FIGURE 21, *a*, *b*

Pallenopsis longirostris WILSON, 1881, pp. 252–253, pl. 4, figs. 19–22; pl. 5, figs. 24, 25.
Phoxichilidium oscitans HOEK, 1881, pp. 89–90, pl. 13, figs. 1–5.
Pallenopsis longirostris VERRILL, 1885, p. 561.
Pallenopsis plumipes MEINERT, 1899, pp. 51–52, pl. 4, figs. 1–7.
Pallenopsis longirostris GILTAY, 1942, p. 459.—NEEDLER, 1943, p. 13, fig. 16.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2046	July 31, 1883	40 02 49	68 49 00	407	1
2470	July 4, 1885	44 47 00	56 33 45	224	1
2554	August 9, 1885	39 48 30	70 40 30	445	1
2628	October 21, 1885	32 24 00	76 55 30	528	2 (ov. ♂)
2699	August 22, 1886	45 04 00	55 23 00	79	1
2734	October 26, 1886	37 23 00	73 53 00	841	1

Most of these specimens have a pale, flabby appearance in their preserved state. The proboscis is larger at the tip than described by Wilson, and the "long natatory bristles" mentioned by Meinert in his description of *P. plumipes* are well developed in some of these speci-

mens but lacking in others. Hence I cannot keep the two species apart. Nor, for that matter, can I find any well-defined character for separating *Pallenopsis oscitans* (Hoek), dredged by the *Challenger* west of the Azores from 1,675 fathoms. The chelae are very similar, and the expanded appearance of the front margin of the cephalic segment in Hoek's figure is not of specific importance and may be more apparent than real. *Pallenopsis longirostris* appears to be a variable species, and the variation in this handful of specimens indicates that both *plumipes* and *oscitans* should be included under this name.

Distribution.—Northeastern Atlantic, Cabot Strait, and Western Atlantic as far south as latitude 32° N., 79 to 1,675 fathoms.

PALLENOPSIS CALCANEA Stephensen

FIGURE 21, *e–g*

?*Pallenopsis* sp. GORDON, 1932, pp. 91–92, fig. 45, *a–c*, fig. 74, *c*.
Pallenopsis calcanea STEPHENSEN, 1933, pp. 21–24, fig. 5.

RECORD OF COLLECTIONS

Bermuda circle [center, lat. 32°12′N., long. 64°36′W.], Net 206, 660 fathoms (deep tow), June 22, 1929, William Beebe coll., 1 female.

This specimen is about the same size as those described by Stephensen. It appears to be a mature female; the genital pores are large, on slight elevations of the *dorsal* surface of the second coxae. The rudimentary (or vestigial?) palpus is larger than in Stephensen's material, and the development of the heel seems to be intermediate between the *Godthaab* specimens from Davis Strait and off Labrador and Gordon's immature specimen from *Discovery* station 256 (lat. 35°14′S., long. 6°49′E., off South Africa; a deep tow between 850–1,100 meters). There is a suggestion of a vestigial auxiliary claw in this specimen. Inasmuch as Stephensen did not give detailed measurements, the following should be of interest:

	Mm.		*Mm.*
Proboscis:		Third leg:	
Length	2. 0	First coxa	1. 75
Diameter at tip	0. 6	Second coxa	2. 18
Trunk	3. 5	Third coxa	1. 25
Cephalic segment	1. 5	Femur	5. 7
Width	2. +	First tibia	5. 75
Abdomen	0. 75	Second tibia	4. 50
Scape	1. 9	Tarsus	0. 48
		Propodus	1. 0
		Claw	0. 6+

Distribution.—Evidently a bathypelagic species of the North and (probably) South Atlantic, and the southern Indian Ocean, occurring at depths of from 500 to 1,000 fathoms. It may be world-wide.

PALLENOPSIS SCHMITTI Hedgpeth

FIGURE 22

Pallenopsis schmitti HEDGPETH, 1943b, p. 44 (diagnosis).

ALBATROSS COLLECTIONS

Station No.	Date	Lat. N.	Long W..	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2138	Feb. 29, 1884	17 44 05	75 39 00	23	1 ♀
2143	Mar. 23, 1884	9 30 45	76 25 30	155	1 ♀
2641	Apr. 9, 1886	25 11 30	80 10 00	60	1 ♂

W. L. SCHMITT—TORTUGAS

--------	June 10, 1925	Tortugas, Fla. (10 miles south of No. 2 buoy, "olive buff and gallstone yellow").	35–37	5
--------	Aug. 4, 1931	South of Tortugas, Fla.	40	1 male and 1 female (cotypes: U.S.N.M. No. 76517).
--------	do	do	--------	10 (paratypes: U. S. N. M. No. 76516).

ADDITIONAL RECORDS

University of Iowa Expedition, Bahamas, 4 specimens.

Tortugas, Fla., June 1908, 8–10 fathoms, among Bryozoa, R. C. Osburn coll., 1 specimen.

Pelican station 169–7, January 18, 1940, lat. 28°24.5′ N., long. 80°03′ W., try net, 45 fathoms, 1 male (ov.).

Johnson-Smithsonian Expedition station 78, February 25, 1933, north of Puerto Rico, lat. 18°29′ N., long. 65°31′ W., about 100 fathoms, 1 specimen.

Description.—Trunk slender, elongated, fully segmented. Lateral processes separated by nearly twice their own diameter. Cephalic segment not widened in front. Eye tubercle conical, acute, but not placed at the extreme anterior end of the cephalic segment as in *P. forficifer*. Eyes pigmented, large; the anterior pair two or three times as large as the posterior pair.

Proboscis about as long as cephalic segment.

Abdomen long, clavate.

Chelifore slender, scape 2-jointed, the first joint as long as the second and nearly as long as the proboscis. Fingers shorter than palm, broad, meeting when closed.

Palpus represented by a rounded knob.

Oviger 10-jointed; in the male the fifth joint is curved and armed with a row of backward-pointing spines at its distal end; the sixth joint is about half as long as the fifth and twice as curved, with reversed spines generally distributed. Terminal segments diminishing in size.

Leg long. Second coxa and femur with a few setae dorsally. First tibia covered dorsally and distally with long setae, as long as twice the diameter of the joint. Second tibia covered with shorter setae. Tarsus very short, propodus thick, with several large, heavy spines on the sole. Auxiliary claws large. The femoral cement gland tube is large, thick-walled, and nearly straight.

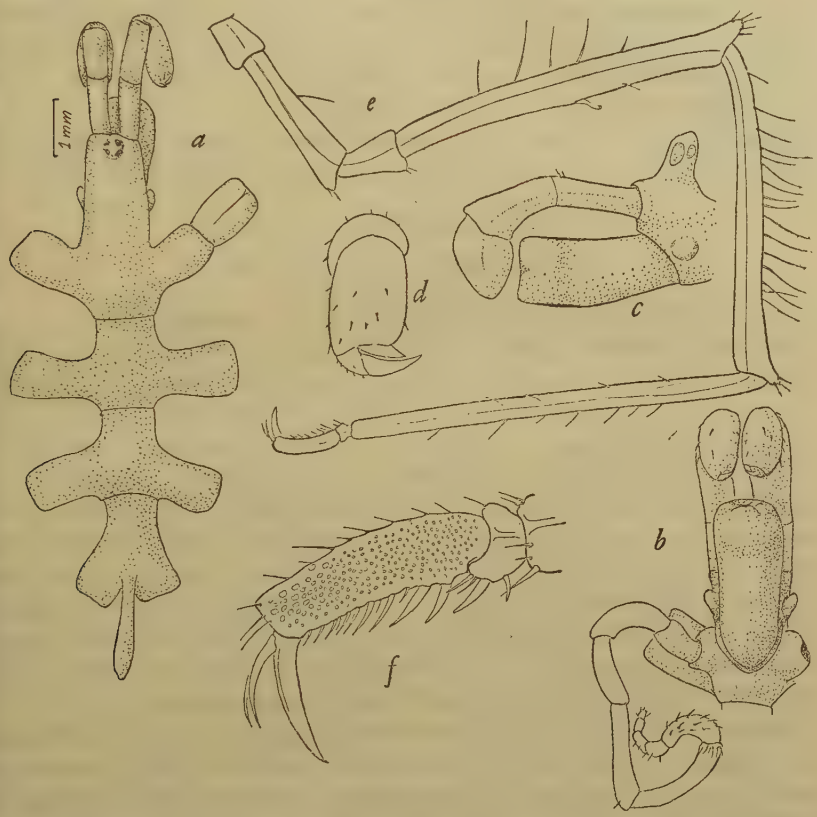

FIGURE 22.—*Pallenopsis schmitti* Hedgpeth: *a*, Dorsal view of cotype (male); *b*, ventral view; *c*, lateral view of chelifore and proboscis; *d*, chela; *e*, leg; *f*, tarsus and propodus.

Measurements (male) as follows (from L. Giltay):

	Mm.
Proboscis, length	2. 5
Trunk, length	7. 0
Abdomen, length	2. 0
Scape:	
First segment	1. 75
Second segment	1. 0

Fourth leg:	*Mm.*
First coxa	1. 75
Second coxa	4. 0
Third coxa	2. 0
Femur	9. 0
First tibia	9. 0
Second tibia	10. 0
Tarsus+propodus	2. 0

Remarks.—This species is characterized by the short, widely separated lateral processes and the heavy appearance of the spines and claws of the propodus. In some specimens the setae on the legs are very fine. The segmentation of the chelifore is difficult to see in many specimens. The lateral chitinous line of the legs and trunk extends out on the scape of the chelifore.

The foregoing description is quoted, with necessary alterations, from a manuscript by the late Dr. Louis Giltay. I am glad to concur with him in dedicating the species to Dr. Waldo L. Schmitt, of the United States National Museum. Unfortunately circumstances made it impossible to preserve Giltay's authorship.

Distribution.—A Caribbean species, from Tortugas, Fla., to the Gulf of Darién; from relatively shallow water, 8–10 to 155 fathoms.

Genus PIGROGROMITUS Calman, 1927

PIGROGROMITUS TIMSANUS Calman

FIGURE 23, *a–d*

Pigrogromitus timsanus CALMAN, 1927, pp. 408–410, fig. 104, *a–f*.

Record of collection.—Lake Worth, Fla., August 28, 1943, WHOI fouling collection, station G 22, 3 feet, 9 specimens, including ovigerous male.

With the exception of a somewhat stronger terminal claw of the oviger, these Florida specimens are inseparable from those found by Calman in the Suez Canal. It is probable that the difference in the oviger is due more to the angle at which the structure became fixed under the cover glass than to actual differences, since the rest of the armature of the oviger is so similar. The Florida specimens are about the same size as the types, and the proboscis has the same partial constriction in the middle (not well shown in Calman's dorsal view, fig. 104a). The egg mass is single, as in *Pycnogonum*.

The occurrence of this species in the Suez Canal and the Florida coast region is an interesting distribution puzzle, although not a surprising one, in view of the distribution of various other species on both sides of the Atlantic. The transitional peculiarities of this form have already been commented upon (Hedgpeth, 1947, p. 7). In consulting the passage of *Twelfth Night* from which the name of this genus was borrowed, I find the following: "In sooth, thou wast in very gracious fooling last night, when thou spokest of Pigrogromitus, of the Vapians passing the equinoctial of Queubus . . ." (Act. II, sc. iii). In sooth, we taxonomists are hard put to it to find names, but there have been far worse sources than the nonsense of Will Shakespeare. It seems that Barnard (1946, p. 63) is of the same opinion, for he has suggested *Queubus* as a generic name for a form somewhat resembling *Pigrogromitus*, although it differs from it in lacking both chelifores and palpi. Inasmuch as this new form is so far known only from a

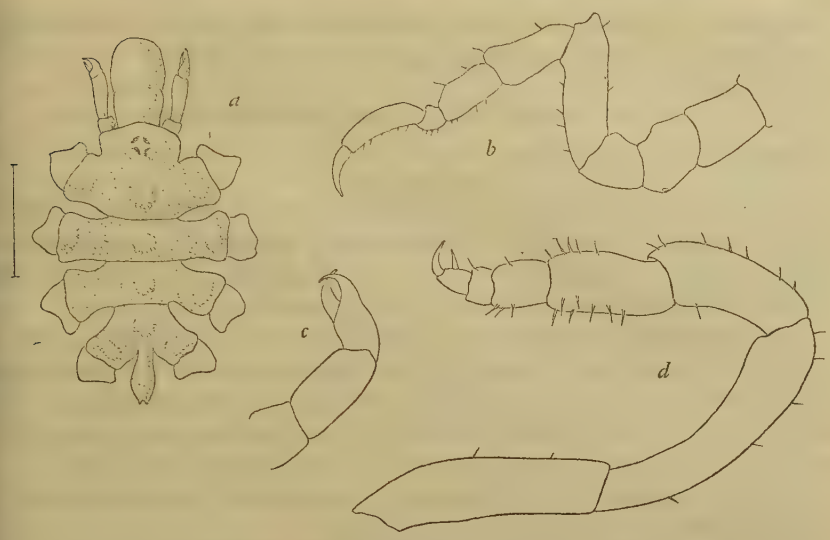

FIGURE 23.—*Pigrogromitus timsanus* Calman: *a*, Dorsal view of male; *b*, third leg of male; *c*, chelifore; *d*, oviger.

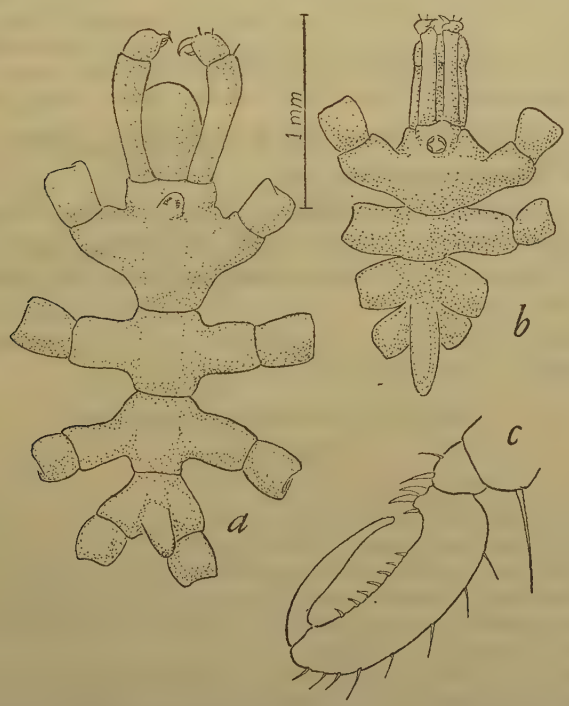

FIGURE 24.—*a*, *Phoxichilidium femoratum* (Rathke); *b*, *c*, *Halosoma robustum* (Dohrn).

preliminary diagnosis, it is not possible to discuss its relationships adequately. It does, however, have 10-jointed ovigers.

Family PHOXICHILIDIIDAE Sars, 1891

Phoxichilidiidae MARCUS, 1940b.

The principal characters of this family are the presence of ovigers only in the male (there may be rudimentary stumps in some females), 2-jointed chelifores, and the absence of palpi. The ovigers are usually 6-jointed but vary from 5- to 9-jointed.

The genera and species in this family are vaguely defined; many of the species, especially in the genus *Anoplodactylus*, may be synonyms, and all told the family is a difficult problem for the taxonomist. It is of particular interest to the ecologist and student of animal distribution because of the pelagic habit of several of its species.

Three genera, keyed as follows, are recognized in the waters under consideration:

1. Cephalic segment extended forward as a conspicuous neck, overhanging insertion of proboscis (auxiliary claws minute) ..... **Anoplodactylus** (p. 218)
   Cephalic segment not extended forward 2
2. Lateral processes separated by at least their own diameter; propodus with auxiliary claws ..... **Phoxichilidium** (p. 216)
   Lateral processes separated by less than their own diameter; auxiliary claws minute ..... **Halosoma** (p. 217)

[The distinction between *Phoxichilidium* and *Halosoma* applies only to the species in this paper.]

Genus PHOXICHILIDIUM Milne-Edwards, 1840

Phoxichilidium MARCUS, 1940b, pp. 36–39.

Chelifore 2-jointed, chela small. Palpi lacking. Ovigers 5- or 6-jointed, present only in males. Propodus with prominent auxiliary claws. The cephalic segment is not markedly projected over the insertion of the proboscis.

This genus is represented by a single species, *P. femoratum*, in the waters of eastern North America.

PHOXICHILIDIUM FEMORATUM (Rathke)

FIGURE 24, *a*

Nymphon femoratum RATHKE, 1799, p. 201.
Phoxichilidium maxillare STIMPSON, 1853, p. 37.
Phoxichilidium femoratum VERRILL, 1874a, p. 45.
Phoxichilidium maxillare WILSON, 1878b, pp. 12–13, pl. 4, fig. 1, *a–e*.
Phoxichilidium minor WILSON, 1878b, pp. 13–14, pl. 4, fig. 2, *a–f*.
Phoxichilidium maxillare WILSON, 1880, pp. 480–481, pl. 3, figs. 12–15.
Non *Phoxichilidium maxillare* MORGAN, 1891.
Phoxichilidium maxillare WHITEAVES, 1901, p. 263.—PEARSE, 1914, p. 77.
Phoxichilidium femoratum NEEDLER, 1943, p. 14, fig. 18, *a–f*.—LEBOUR, 1945, p. 146, figs. 1, *a–c*, 2*a*.

This is one of the commonest littoral pycnogonids of the New England coast north of Cape Cod and is sparingly found as far south as Long Island Sound. It is found also on the coast of Europe from Norway to France, Iceland, Greenland, and on the Pacific coast of North America as far south as the Los Angeles region, but it has not been reported from Japan. The bathymetric range in the New England region is from shore line to 55 fathoms. According to Lebour, this species lives principally on *Syncoryne*. This author has proposed (1945, pp. 147–150) another species, *P. tubulariae*, which is smaller and has a longer abdomen and a somewhat different armature of spines on the propodus. The larvae are found in the gastral cavity of *Tubularia*. The anatomical characters of this species, with the exception of the longer abdomen, agree with Wilson's (1878b) *P. minor*, which he subsequently (1880) reduced to synonymy under *P. maxillare*. His figures of the tarsus of this smaller variety agree very much with Lebour's figure (2*b*) of the tarsus of her *P. tubulariae*. It would appear that *P. minor* is an intermediate form between *femoratum* and *tubulariae* and that it would be very difficult to keep these species apart, although they may represent *bona fide* geographic races. Lebour's form should probably be considered a variety rather than a full species. Obviously this species requires further study, based on a large series of specimens.

Genus HALOSOMA Cole, 1904

Halosoma Cole, 1904a, p. 286; Hilton, 1915, p. 69; Marcus, 1940b, pp. 43–46.

Chelifores 2-jointed, with small chelae. Palpi lacking. Oviger 5- or 6-jointed. The trunk is compact, shield-shaped or circular, and with no conspicuous neck. There are minute auxiliary claws.

This genus was established by Cole (1904a, p. 286) on a single female specimen. The oviger of the genotype, *Halosoma viridintestinale*, has not been figured previously (fig. 25, *a*). Hilton was in error in de-

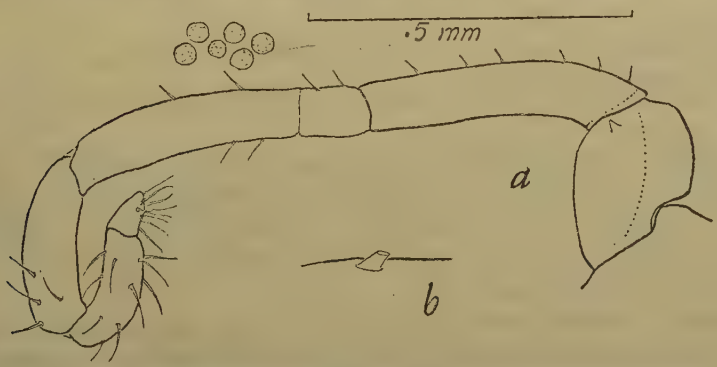

Figure 25.—*Halosoma viridintestinale* Cole: *a*, Oviger; *b*, femoral cement gland.

scribing it as 5-jointed; there are six articulated joints and a segmentation near the base of the third joint. As generic characters, distinguishing *Halosoma* from *Phoxichilidium*, Cole (loc. cit.) mentions the compact body with the last pair of lateral processes slightly separated from the preceding pair and the intermediate development of the neck (between *Phoxichilidium* and *Anoplodactylus*). The position of the lateral processes is somewhat variable in the genotype, however, and in a few specimens the body is completely circular. The femoral cement gland of *Halosoma viridintestinale* is of particular interest (fig. 25, *b*). Viewed from directly above, it appears to be a circular opening at about the middle of the dorsal surface of the femur. From the side, however, it is a very short tubular process. The walls of the tube are transparent and cannot be easily demonstrated. Genital protuberances occur on the last two pair of coxae in the genotype, about a third as long as the width of the joint, rounded.

HALOSOMA ROBUSTUM (Dohrn)

FIGURE 24, *b*, *c*

Phoxichilidium robustum DOHRN, 1881, p. 188, pl. 12, figs. 13–18.
Anoplodactylus robustus BOUVIER, 1923, p. 43, fig. 40.
Halosoma robustum MARCUS, 1940b, pp. 68–71, fig. 8, *a-c*.

RECORD OF COLLECTIONS

Loggerhead Key, Tortugas, Fla., from algae and old coral rock, 4 feet, July 14, 1926, C. R. Shoemaker coll., 1 specimen (female).

This single female specimen appears to be *Halosoma* because of the slightly developed neck and narrowly separated lateral processes. The forward end of the cephalic segment is raised, and there are long spines on the tibiae as in *H. robustum*. Identification of an isolated female in this family is subject to reservation, however, and further collections may prove this to be another species, possibly *Phoxichilidium virescens* Hodge.

Genus ANOPLODACTYLUS Wilson, 1878

Anaphia SAY, 1821, p. 59.
Anoplodactylus WILSON, 1878a, p. 200; 1880, p. 482.
Anaphia NORMAN, 1908, p. 202.
Anoplodactylus MARCUS, 1940b, pp. 38–43.—WILLIAMS, 1941, pp. 33–35.—LEBOUR, 1945, pp. 154–155.

Chelifores 2-jointed, with small chelae. Palpi lacking, but females in many species with peculiar processes on ventral surface of proboscis. Oviger usually 6-jointed (nine in *A. spinosus* Möbius). Auxiliary claws reduced or minute. Males with conspicuous femoral cement glands, of various types.

Although Wilson (1880) suggested that his *Anoplodactylus* might be congeneric with *Anaphia* Say, he preferred to retain *Anoplodactylus* until specimens from South Carolina, the type locality of Say's

Anaphia pallida, might be collected which would clarify the status of Say's genus. Since that time more than 30 species have been referred to *Anoplodactylus*, and Norman's attempt to reinstate *Anaphia* was ignored by taxonomists (with the exception of Carpenter, 1912) and has received but one recognition in ecological literature (Lebour, 1916). In her most recent paper Lebour (1945) returns to *Anoplodactylus* without comment.

According to the collections studied for this review, *Anoplodactylus lentus* Wilson is the commonest species of pycnogonid on the coast of South Carolina, but *Phoxichilidium femoratum* (Rathke), the species to which Say's description might also apply inasmuch as it was based on female specimens, does not occur south of Long Island Sound (see fig. 26). Say's types appear to be no longer in existence, which makes it impossible to settle the matter with absolute finality.[21] Even if the types were still extant, however, more would be lost than gained by restoring Say's genus. Such a procedure would cause more unnecessary confusion in a group which has already had more than its share of such unhappy taxonomy. Therefore it is urged that *Anoplodactylus* Wilson be retained and that *Anaphia* Say be rejected from further consideration, and be relegated to the status of a *nomen oblitum*, since it has not been in general use for more than 30 years. It is understood that this modification in the International Rules may be considered by the next committee.[22]

The principal character of this genus is the prominently developed neck. The oviger is usually 6-jointed (with a nonarticulated segmentation on the third joint in many species). Wilson considered the apparent absence of auxiliary claws a generic character and coined his name to describe that condition, but minute auxiliary claws are present in most of the species, including *Anoplodactylus lentus*. The femoral cement glands of the males are of several types: In *A. lentus* the opening is a long slit on the median dorsal surface; in *A. petiolatus* it is a short, tubular projection; and in *A. insignis* it is an oval cribriform aperture. Still another form, which seems to be transitional between the tubular and cribriform types, is found in *A. quadratispinosus*. This is a curious transparent vesicle (fig. 32, *b*), with a pore at the summit.

The females of many species have peculiar processes or tubercles on the ventral surface of the proboscis. In some species these are simple knobs; in others they are elaborate lobed processes. Their function and anatomical significance are obscure; Calman (1923, p. 289) has pointed out that they cannot be considered embryonic

[21] I am indebted to Dr. Richard A. McLean, who kindly searched the Say collections at the Academy of Natural Sciences of Philadelphia in my behalf for Say's types. How fortunate that Rafinesque described no pycnogonids!

[22] See Ernest Mayr, "Systematics and the Origin of Species," p. 17, 1942.

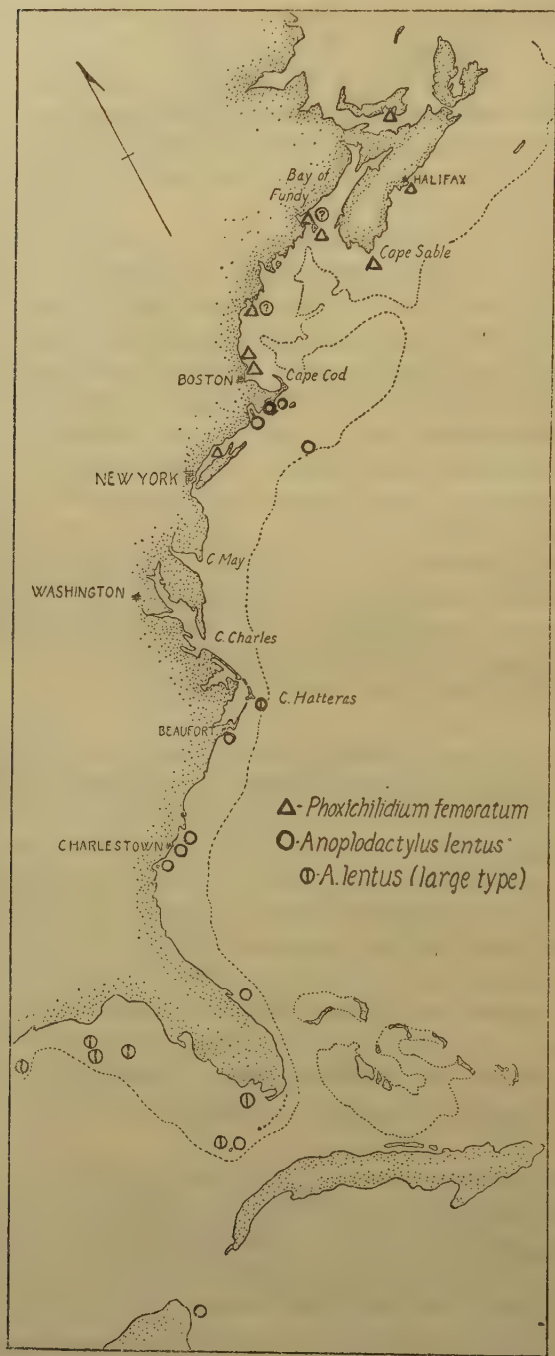

FIGURE 26.—Distribution of *Anoplodactylus lentus* Wilson and *Phoxichilidium femoratum* (Rathke).

limb buds, "since the proboscis, whatever its morphological nature may be, is not a somite."

On the whole, the species of *Anoplodactylus* are a nondescript lot of variable organisms separated by rather vaguely defined characters, and identification is not always certain unless both sexes are available. There are at least 13 species from the Caribbean region alone, 11 of which are included in the following key, according to general characters applicable to both sexes. An unidentifiable species (A, p. 236) from Tortugas is not included in this key, but the male is separable from all the other species in the region on the basis of a very slndeer tubular cement gland at the distal end of the femur. Another species (B, p. 236), represented by a single damaged female specimen, can be separated on the basis of its large chelae, unadorned legs, and a short, tuberclelike projection on the propodus.

Williams, in his short paper on the "revision" of this genus (1941), presents a map indicating the occurrence of *Anoplodactylus parvus* off Venezuela instead of Bermuda, *A. maritimus* just east of the Virgin Islands instead of south of the Azores, and placing Bermuda about 5° east of its true position. It is unfortunate that more care was not devoted to the preparation of this map, which does indicate the predominantly tropical distribution of the genus.

KEY TO THE SPECIES OF ANOPLODACTYLUS DISCUSSED IN THIS REPORT

1. Second tibia not markedly shorter than first 2
   Second tibia less than half as long as first ..... **evelinae** (p. 232)
2. Proboscis cylindrical 3
   Proboscis styliform ..... **stylirostris**, new species (p. 232)
3. Eye tubercle and abdomen not conspicuously long; sole of propodus without square spines 4

   [Fingers of chelae (spinose, except at tips?) conspicuously longer than palm (usually about as long as palm in other species in this group); propodus with a long, bluntly rounded projection at its distal end (Mediterranean, North Africa). (Sp. B, p. 236, has a short tubercle on the propodus). *massiliensis* Bouvier]

   Eye tubercle and abdomen very long, erect; sole of propodus with a row of square spines ..... **quadratispinosus** (p. 232)
4. With prominent conical or rounded projections at end of femur 12
   Without such processes on femur 5
5. Basal spines of propodus simple 6
   Largest basal spine denticulate ..... **pectinus**, new species (p. 234)
6. Fingers long, slender, with setae; palm elongate or angular 7
   Fingers of chela short, curved, opposed, or slightly crossed 8
7. Eye tubercle very low, eyes present ..... ?**maritimus** (p. 230)
   Eye tubercle imperceptible or lacking, eyes absent ..... **typhlops** (p. 228)
8. With low tubercles at ends of lateral processes, or basal spines of propodus less than half as long as width of propodus 9
   Without tubercles or processes on lateral processes; basal spines on propodus at least half as long as width of the propodus ..... **lentus** (p. 225)
9. Eye tubercle not conical or conspicuously broader at base; two or three or more large spines on heel of propodus 10

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Eye tubercle conical, with a broad base; one or two large curved spines on heel of propodus ..... **carvalhoi** (p. 230)

[Proboscis obtusely conical at tip (blunt in *carvalhoi*); chelae not so spinose as *carvalhoi*, but tibia more so (Brazil to 5° S.) ..... *stictus* Marcus

10. Cephalic segment overhanging proboscis by at least half its length; with minute auxiliary claws 11

Cephalic segment short, little beyond base of proboscis; without auxiliary claws ..... **pygmaeus** (p. 224)

[Cephalic segment slightly longer; scape of chelifore slightly expanded distally (southern Brazil) *brasiliensis*, new name pro *pygmaeus* Marcus]

11. With low tubercles on lateral processes and first coxae; a few long setae on legs ..... **petiolatus** (p. 222)

Tubercles absent or inconspicuous; legs without setae or with very few. **parvus** (p. 223)

12. Processes on scape of chelifore overhanging insertion of chelae; conical processes on dorsodistal ends of femur and tibiae ..... **insignis** (p. 226)

Scape without overhanging process; processes on femur rounded, lacking or inconspicuous on tibiae ..... **polignaci** (p. 230)

ANOPLODACTYLUS PETIOLATUS (Krøyer)

FIGURE 27, *a–d*

Phoxichilidium petiolatum KRØYER, 1844, p. 123.
Anoplodactylus petiolatus SARS, 1891, pp. 25–29, pl. 2, fig. 2, *a–1*.
Anaphia petiolata LEBOUR, 1916, pp. 51–56, figs. 1–3.
Anoplodactylus petiolatus TIMMERMANN, 1932, p. 327, fig. 3.—MARCUS, 1940b, pp. 61–62, fig. 5, *a*, *b*.—LEBOUR, 1945, pp. 157–159, fig. 6, *a–h*.

RECORDS OF COLLECTION

Albatross station 2307, Oct. 21, 1884, lat. 35°42′00″ N., long. 74°54′30″ W., 43 fathoms, 5 specimens.

St. Joseph Island, Tex., from sargassum cast on beach, April 16, 1946, J. W. Hedgpeth coll., 12 specimens (including ovigerous males).

The females of the Texas specimens are almost glabrous; the males are slightly spinose. Although the lateral processes of the *Albatross* specimens (used in preparing the figure) are more widely separated than seems characteristic for this species, they are otherwise inseparable from *A. petiolatus*.

Distribution.—*Anoplodactylus petiolatus* is widely distributed along the European coast from Norway (about lat. 69° N.) to the Mediterranean and in the Sargasso Sea; in Santos Bay, Brazil, and the Beagle Channel (Tierra del Fuego) and on the coast of southern Chile. These southern records may not be of the same species. As Marcus (1940b, pp. 41–42) has shown, the widely published record of Alaska for this species is based on Norman's (1908, p. 202) error in misinterpreting a comparative table of differences between *A. petiolatus* and *A. erectus* Cole in Cole's (1904a) paper on California and Alaskan pycnogonids. It has not yet been collected in North Pacific waters.

ANOPLODACTYLUS PARVUS Giltay

FIGURE 27, *e*, *f*

Anoplodactylus parvus GILTAY, 1934, pp. 1–3, figs. 1–5.

Fish Hawk records.—Station 8826, July 8, 1920, Chesapeake Bay, off Plantation Point, 45.75 fathoms, 1 male; station 8887, October 19, 1920, Chesapeake Bay off Rappahannock Spit, 12.81 fathoms, 1 male.

The principal differences between this species and *A. petiolatus* are its smaller size, reduction of tubercles on the lateral processes, and comparatively fewer spines on the legs. Both species have tubular cement glands of the same type, and may prove to be the same. Timmermann (1932, p. 327) comments on the small size of his speci-

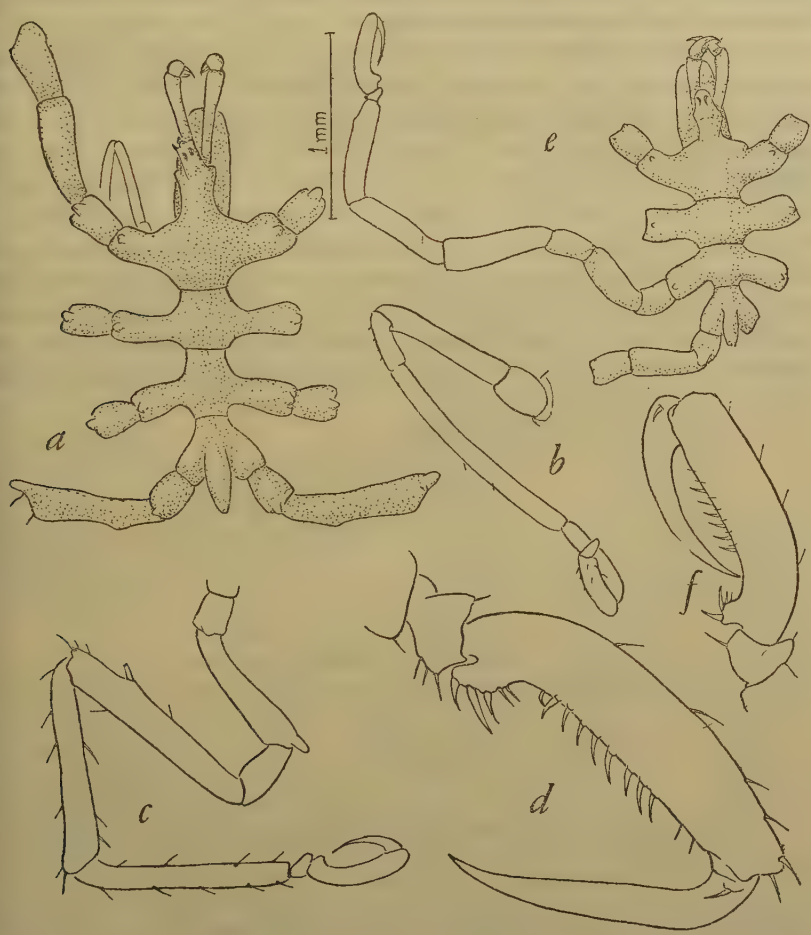

FIGURE 27.—*a–d*, *Anoplodactylus petiolatus* (Krøyer); *e*, *f*, *A. parvus* Giltay.

mens of *A. petiolatus* taken from the sargassum, and it is possible that his collections represent an intermediate form, if not this form, which was described by Giltay from Bermuda.

ANOPLODACTYLUS PYGMAEUS (Hodge)

FIGURE 27A

Pallene pygmaea HODGE, 1864, p. 116, pl. 13, figs. 16, 17.
Phoxichilidium exiguum DOHRN, 1881, p. 181, pl. 12, figs. 19–22.
Nec *Anoplodactylus pygmaeus* MARCUS, 1940b, pp 63–64, pl. 6, fig. 6*a–d*.
Anoplodactylus pygmaeus LEBOUR, 1945, pp. 159–162, fig. 7*a–l*.

RECORDS OF COLLECTIONS

Norfolk, Va., August 8, 1944, WHOI fouling collection, station E 16, 2 males (1 ov.), 1 female. Also 1 male, station E 17, same area and date.

Galveston, Tex., October 12, 1943, WHOI fouling collection, station I 25, several specimens including ovigerous males.

This minute species, which indicates, in the comparatively short cephalic segment, a transitional phase between *Anoplodactylus* and *Halosoma*, is evidently widely distributed. It may have been confused with *A. petiolatus* as a member of the sargassum fauna. As Lebour has shown, the species described by Marcus under this name is not the same, and for it I propose the new name *Anoplodactylus brasiliensis*. These specimens from Virginia and Texas agree, in the proportions of the joints of the ovigers, as well as in the presence of small tubercles on the lateral processes, with the European forms as described by Dohrn and Lebour. It is easily separable from *A. petiolatus* on the basis of the smaller size, presence of small spinose

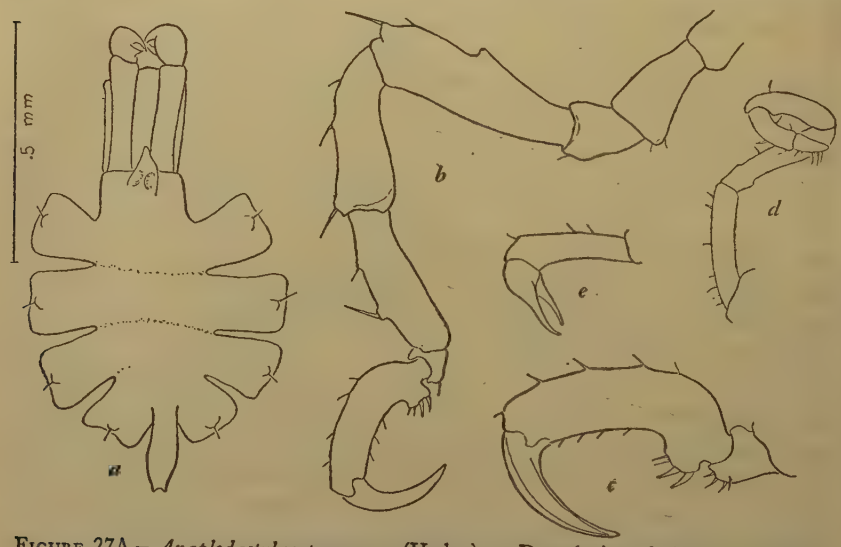

FIGURE 27A.—*Anaplodactylus pygmaeus* (Hodge): *a*, Dorsal view; *b*, leg; *c*, tarsus and propodus; *d*, oviger; *e*, chela.

tubercles, and the relatively short cephalic segment. In *petiolatus* the cephalic segment overhangs the proboscis. This is also the case with the Brazilian species described by Marcus, although the projection is shorter.

ANOPLODACTYLUS LENTUS Wilson

FIGURE 28, *a-c*

Anaphia pallida SAY, 1821, pp. 59-61, pl. 5, fig. 7.
Phoxichilidium maxillare VERRILL, 1873b, p. 250 (544), pl. 7, fig. 35.
Anoplodactylus lentus WILSON, 1878a, p. 200; 1878b, pp. 14–15, pl. 4, fig. 3, *a-c;* 1880, pp. 482–483, pl. 3, figs. 16–18.
Phoxichilidium maxillare MORGAN, 1891 (embryology).
Anoplodactylus lentus COLE, 1901, pp. 195–207 (habits); 1906b, pp. 740–741 (habits).
Anaphia lenta NORMAN, 1908, p. 204.
Anoplodactylus lentus SUMNER, OSBURN, and COLE, 1913, pp. 142–143, 677, chart 121 (distribution map).—FISH, 1925, p. 161.—DAWSON, 1934, pp. 62–68, pl. 1, figs. 1–17 (character of blood).—HEDGPETH, 1943b, p. 45.—NEEDLER, 1943, p. 14, fig. 17, *a-d.*

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2280	Oct. 19, 1884	35 21 00	75 21 30	16	1♀
2316	Jan. 15, 1885	24 25 30	81 47 45	50	1♂, 1♀
2354	Jan. 22, 1885	20 59 30	86 23 45	130	1♀
2370	Feb. 7, 1885	29 18 15	85 32 10	25	1♂, 2♀♀
2371	do	29 17 00	85 30 45	26	1♀
2372	do	29 15 30	85 29 30	27	1♂
2373	do	29 14 00	85 29 15	25	1♀
2375	do	29 10 00	85 31 00	30	2♀♀
2391	Mar. 4, 1885	29 32 00	87 45 00	25	1♂, 1♀
2405	Mar. 15, 1885	28 45 00	85 02 00	30	1♀
2596	Oct. 17, 1885	35 08 30	75 10 00	49	5+

FISH HAWK RECORDS

1649	Jan. 16, 1891	Calibogue Sound, S. C.	7	25+
1651	do	do	10	5

ADDITIONAL RECORDS

Beaufort, N. C., Pivers Island, Laboratory Wharf, Nov. 2, 1927, J. S. Gutsell coll., 2 females.

Beaufort, N. C., June 1942, R. A. McLean coll., 1 male (ov.).

Folly River, S. C., Apr. 24, 1935, 2–3 fathoms, sand and mud, 5 specimens (including ovigerous males).

Tybee Island, Ga., 1888, 1 female, dried mounted in box (A.M.N.H.).

Tortugas, Fla., April 1904, C. H. Edmondson coll., 3 specimens.

South of Tortugas, Fla., June 10, 1925, W. L. Schmitt coll., 3 females, "prune purple."

Pelican station 169–7, lat. 28°24.5′N., long. 80°03′W., Jan. 18, 1940, 45 fathoms, try net, 2 males.

Also 300+ specimens from Woods Hole, Mass., and vicinity, various dates.

The characteristic features of this species are the lack of tubercles or processes on the lateral processes and legs, lack of noticeable spines on the body or legs, and the simple slitlike femoral cement gland of the male. There are no ventral growths on the proboscis of the female. Some specimens, particularly those from the Caribbean, are quite large, with an extent of at least 3 inches (7.5 cm.), while those found at Woods Hole and on the South Carolina coast are about half that size. A specimen intermediate in size was taken off Yucatán (*Albatross* station 2354). The distribution of these two forms is indicated by different symbols in figure 26. Some of the large Caribbean specimens are deep purple in color in life, as are many of the smaller Woods Hole specimens.

Wilson (1880, p. 483) lists a specimen from Eastport, Maine, and in the National Museum collection there is a single specimen labeled "Casco Bay, 1873." Both of these records may be errors in labeling; at any rate, *A. lentus* is rare north of Cape Cod. Its abundance at Calibogue Sound, not far from Charleston, suggests that Say's *Anaphia pallida* is the same species, inasmuch as Charleston was the type locality of Say's species.

The breeding season of *A. lentus* at Woods Hole is August (Cole, 1901); ovigerous males were taken in June at Beaufort, N. C., and in April from Calibogue Sound. None of the Caribbean specimens are ovigerous.

Dawson has described the colored corpuscles in the blood of this species in some detail. The coloring matter is neither hemoglobin nor hemerythrin, and may have some respiratory function.

ANOPLODACTYLUS INSIGNIS (Hoek)

FIGURE 28, *d-g*

Phoxichilidium insigne HOEK, 1881, pp. 82–84, pl. 14, figs. 5–7 [? p. 107, pl. 16, fig. 18].

Anoplodactylus insignis bermudensis COLE, 1904b, pp. 325–327, pl. 20, figs. 1–3; pl. 22, figs. 21–29.

Anoplodactylus insignis MARCUS, 1940b, pp. 58–60.

Anoplodactylus insignis bermudensis MARCUS, 1940b, p. 40.

Anoplodactylus insignis HEDGPETH, 1943b, p. 45.

FISH HAWK RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
7148	Nov. 6, 1901	29 48 10	83 55 15	5	1♂ (ov.)
7201	Dec. 6, 1901	29 32 30	83 50 00	9	1♂
7288	Feb. 24, 1902	24 42 50	81 53 38	7	1♂
7293	Feb. 24, 1902	24 42 30	81 55 52	7¼	1♂
7351	Dec. 17, 1902	25 09 45	81 18 35	3¼	1♀

ADDITIONAL RECORDS

Albatross station 2269, lat. 35°12′30″ N., long. 75°05′00″ W., Oct. 19, 1884, 48 fathoms, 2 females.

Tortugas, Fla., June 1908, 8–10 fathoms, among Bryozoa, R. C. Osburn coll., 1 female.

One-half mile off east end of Sanibel Island, Fla., Apr. 6, 1933, 6–15 feet, 2 females.

One mile off Sanibel Island, Fla., Apr. 10, 1933, 24–27 feet, 1 female.

Pelican station 169–7, lat. 28°24.5′ N., long. 80°03′W., Jan. 18, 1940, 45 fathoms, try net, 4 females.

Thetis Expedition station 10, three-eighths mile northwest by west of North Anclote Channel, Fla., November 17, 1941, sand bottom, 3 fathoms, 1 female (AMNH).

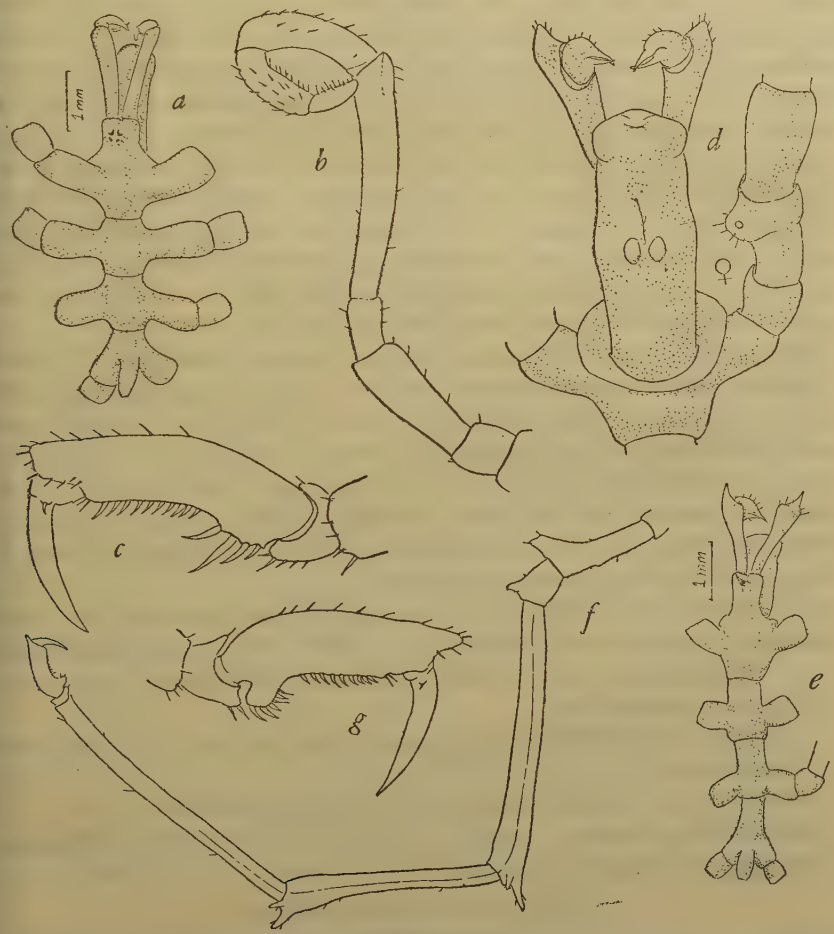

FIGURE 28.—*a–c*, *Anoplodactylus lentus* Wilson: *a*, Dorsal view of trunk; *b*, oviger; *c*, tarsus and propodus; *d–g*, *A. insignis* (Hoek): *d*, ventral view of anterior part of female; *e*, dorsal view of trunk; *f*, leg (female); *g*, tarsus and propodus.

Cole's variety *bermudensis* of this species was proposed for specimens which differed from Hoek's description in that they lacked lateroventral tubercles on the femur, were indistinctly segmented between the third and fourth trunk segments, and had cribriform cement glands. I have reexamined these Bermuda specimens and find that they fall within the wide range of variation for this plastic species. In some of the Florida region material, notably the females from Tortugas and the male collected at *Fish Hawk* station 7201, these femoral protuberances are identical with those illustrated by Hoek (pl. 14, fig. 5), but in another specimen (*Fish Hawk* station 7148) they are very low, and they are lacking in the other specimens. On none of the material could I find anything like the gland elaborately illustrated by Hoek (pl. 16, fig. 18), and no such gland is mentioned in his formal description of the species. Reference to it is made in a later section of his paper, in which he refers to the cement gland of this species as a "single pore at the end of the joint, placed at the tip of a conical excrescence." Reference of this structure to *A. insignis* is clearly a *lapsus calami;* there is nothing in Hoek's description of *Phoxichilidium insigne* or in the figures to indicate the presence of such a "conical excrescence." My suspicions have been confirmed by Dr. Isabella Gordon, who examined the *Challenger* type for me and found an open cribriform structure on the femur, of the type encountered in all the males from these collections.

Some of the female specimens have a completely segmented trunk. The ventral processes on the proboscis of the female are very variable, in some they are entirely lacking, in others they are quite prominent, resembling a pair of cones, projected forward. An intermediate condition is represented in figure 28, *d*. The blunt condition of the eye tubercle described by Hoek was probably a result of the same rough treatment which deprived his specimen of three of its legs; in most of these specimens the tubercle is pointed.

The genital protuberances of the female are relatively low and broad, with pores on all of them. In some of the male specimens these protuberances are very long, but apparently functional only in the last two pairs of legs.

The cribriform gland opening is a narrow ellipse with a longitudinal dividing septum.

In size the specimens vary from 25 to 40 mm. in extent.

Distribution.—Bahia, Brazil, to Bermuda, off Cape Hatteras, Tortugas, and western Florida.

ANOPLODACTYLUS TYPHLOPS Sars

FIGURE 29, *a-c*

Anoplodactylus typhlops SARS, 1888, No. 6; 1891, pp. 29–31, pl. 2, fig. 3, *a-c*.—CARPENTER, 1905, p. 5, pl. 3, figs. 12–19.—STEPHENSEN, 1935, pp. 29–30.

Record of collection.—Tortugas, Fla., 582 (?) fathoms, July 30, 1932, W. L. Schmitt coll., 1 female.

This species has been reported from Norway (near Trondheimfjord) and off Achill Head, Ireland. The latter record is a deep pelagic tow. The origin of the ovigers is well out on the lateral processes of the cephalic segment. *Anoplodactylus neglectus* Hock (1898, pp. 293–295) is very similar to this species and would probably be considered identical with it had it not been collected in the sub-Antarctic between Prince Edward Island and Crozet Island.

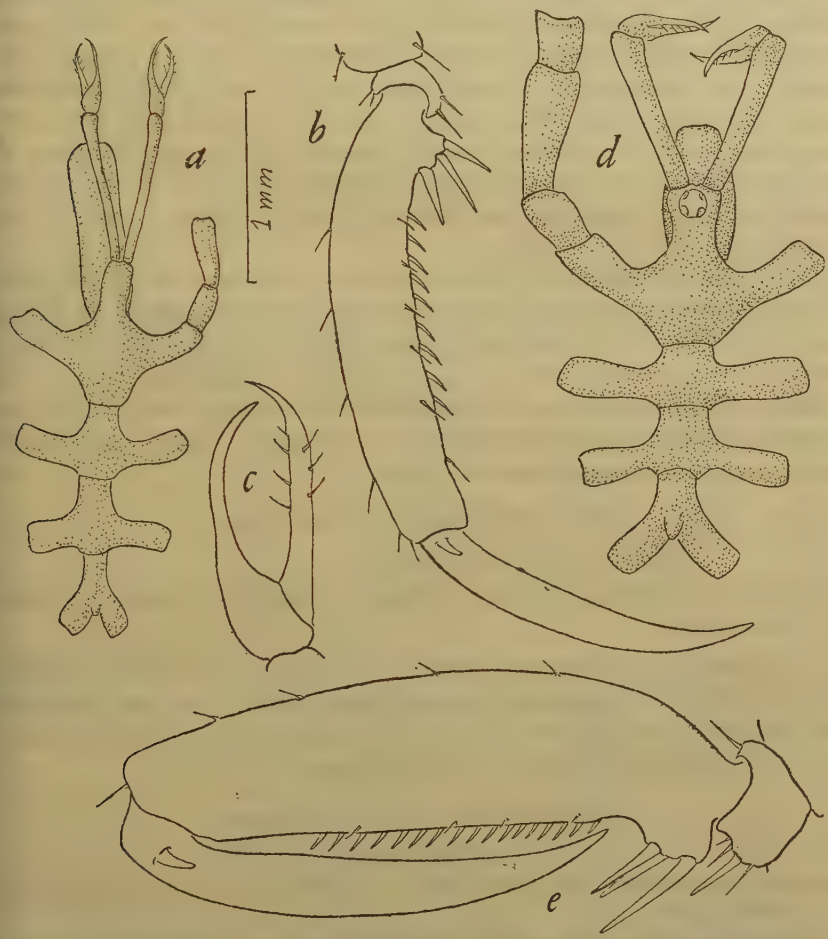

FIGURE 29.—*a–c*, *Anoplodactylus typhlops* Sars; *d*, *e*, ? *A. maritimus* Hodgson.

? ANOPLODACTYLUS MARITIMUS Hodgson

FIGURE 29, *d*, *e*

Anoplodactylus maritimus HODGSON, 1914, p. 164; 1915, p. 148.
Anoplodactylos maritimus HODGSON, 1927, p. 357.
Anoplodactylus maritimus MARCUS, 1940b, p. 60.

Record of collection.—Off Habana, Cuba, State University of Iowa Bahamas Expedition, 1893. 1 female.

Hodgson's regrettable eagerness to establish the priority of his names has deprived us of an adequate description of this species, and the reference of this specimen to *A. maritimus* is little more than a guess. The principal points of his hazy descriptions are the truncate eye tubercle, the lateral processes "scarcely so much as widely separated," and two or three large spines on the heel of the propodus. This specimen does not disagree with that description. Marcus suggests that *A. maritimus* may be related to *A. insignis* and *A. polignaci*, but it is hard to imagine that the existence of prominent processes on the legs (as possessed by these two species) would pass unnoted.

It is possible that *A. maritimus* may be the same as *A. pelagicus* Flynn (1928, pp. 25–27, fig. 14), which was collected off South Africa in a surface tow. Except for its more robust appearance, the specimen before me is very close to *A. pelagicus*. Unfortunately this is a female specimen and cannot certainly be referred to any known species or designated as the type of a new species. The tibial joints are not spiny as in *A. pelagicus*, however.

ANOPLODACTYLUS POLIGNACI Bouvier

FIGURE 30, *a–d*

Anoplodactylus polignaci BOUVIER, 1914a, pp. 223–226.—HEDGPETH, 1943b, pp. 45–46.

A single male specimen was taken by the *Bache* off Sombrero Key, Fla., in 1872. The femoral cement gland, which was not described by Bouvier, is of the cribriform type, located on a raised eminence. It has a conspicuous, raised, transparent rim.

ANOPLODACTYLUS CARVALHOI Marcus

FIGURE 30, *e–g*

Anoplodactylus carvalhoi MARCUS, 1940b, pp. 50–54, fig. 3, *a–k*.—HEDGPETH, 1943b, p. 46.

Record of collections.—Smithsonian-Hartford Expedition station 37, St. Croix, Virgin Islands, Salt River Lagoon, from mangrove roots, Apr. 10, 1937, Kai Essman and W. L. Schmitt colls., 8 males and 5 females.

Previously reported from the coast of southern Brazil. The processes on the ventral surface of the female proboscis are elaborate

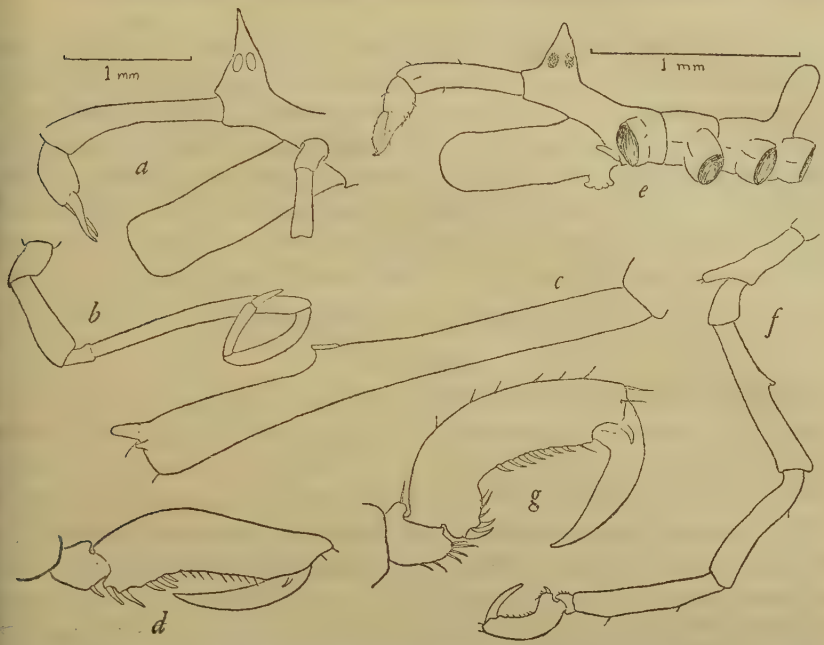

FIGURE 30.—*a–d*, *Anoplodactylus polignaci* Bouvier: *a*, Lateral view of cephalic segment; *b*, oviger; *c*, femur; *d*, tarsus and propodus. *e–g*, *A. carvalhoi* Marcus: *e*, Lateral view of female; *f*, third leg of male; *g*, tarsus and propodus.

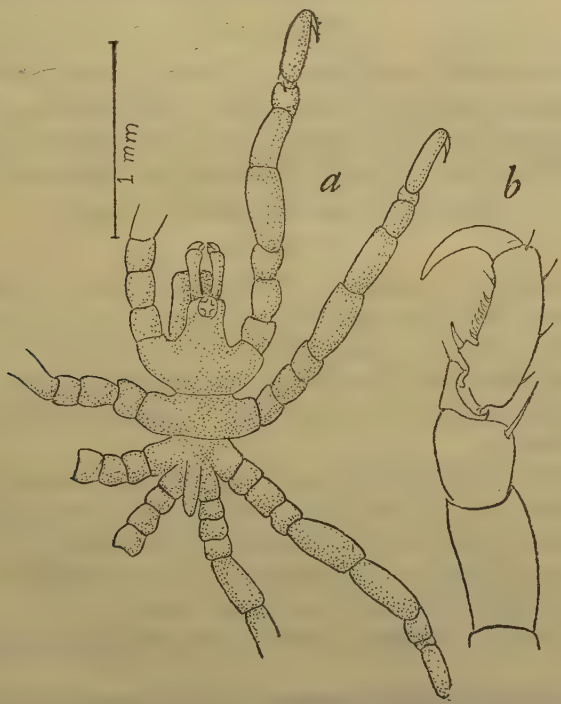

FIGURE 31.—*Anoplodactylus evelinae* Marcus: *a*, Dorsal view; *b*, terminal joints of leg.

lobed structures, and in addition there are fingerlike processes near the base of the proboscis which appear to be rudimentary palpi. These structures are also found in the males. The legs are rather short and the femur and tibiae are subequal. The cement gland opening of the male is a short transparent tube or vesicle on a slight elevation. These preserved specimens are green in color, like those of *Endeis spinosa;* according to Marcus the live animals have rose-red markings on various parts of the trunk and extremities.

ANOPLODACTYLUS EVELINAE Marcus

FIGURE 31

Anoplodactylus evelinae MARCUS, 1940b, pp. 55–58, fig. 4, *a–h*.

Record of collections.—Loggerhead Key, Tortugas, Fla., July 20, 1926, washed from seaweed and sand, shallow water, C. R. Shoemaker coll., 1 female; same, Aug. 13, 1926, from rocks and algae, 1 male.

This curious little pycnogonid was found by Marcus in Santos Bay and Rio de Janeiro Bay. Marcus comments on the doubtful generic status of this species. Giltay (in MS.) proposed the generic name *Labidodactylus* for it, and if future collections demonstrate its right to independence from *Anoplodactylus*, his name might be used.

ANOPLODACTYLUS QUADRATISPINOSUS Hedgpeth

FIGURE 32

Anoplodactylus quadratispinosus HEDGPETH, 1943b, pp. 47–48, pl. 8, figs. *a–g*.

This species is known from a single male specimen collected by Count Pourtalès near Key West in 1869. The square spines on the sole of the propodus are a ready character for identification.

ANOPLODACTYLUS STYLIROSTRIS, new species

FIGURE 33

Types.—Holotype (female): U.S.N.M. No. 81094, off southeast end of Loggerhead Key, Tortugas, Fla., August 9, 1926, about 10 feet, C. R. Shoemaker coll. Paratypes (2 males, 1 ov.): WHOI fouling collection, station G 23, Key West, Fla., August 29, 1943.

Bahamas: September 3, 1943. WHOI fouling collections, station J 6, 1 male (ov).

Description.—Trunk relatively compact, for the genus, lateral processes separated by slightly less than their own diameter. Eye tubercle rounded, about as wide as high, eyes large.

Proboscis styliform, pointed downward and usually not apparent from above. It tapers evenly to a blunt tip.

Abdomen slightly elliptical, about twice as long as the last lateral process.

Chelifore: Scape about as long as distance between eye tubercle and

first lateral process, slightly swollen distally. Chelae small, fingers bowed, opposing at tips.

Leg: Sparsely armed with long setae in male, females with fewer or no spines. Femur of female with slight constriction near middle, male with a moderately prominent distal projection bearing a large spine.

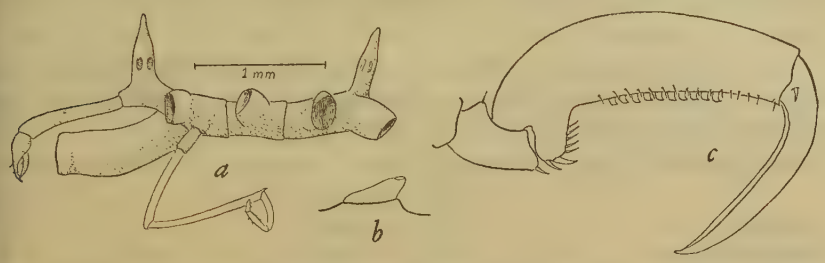

FIGURE 32.—*Anoplodactylus quadratispinosus* Hedgpeth: *a*, Lateral view; *b*, femoral cement gland; *c*, tarsus and propodus.

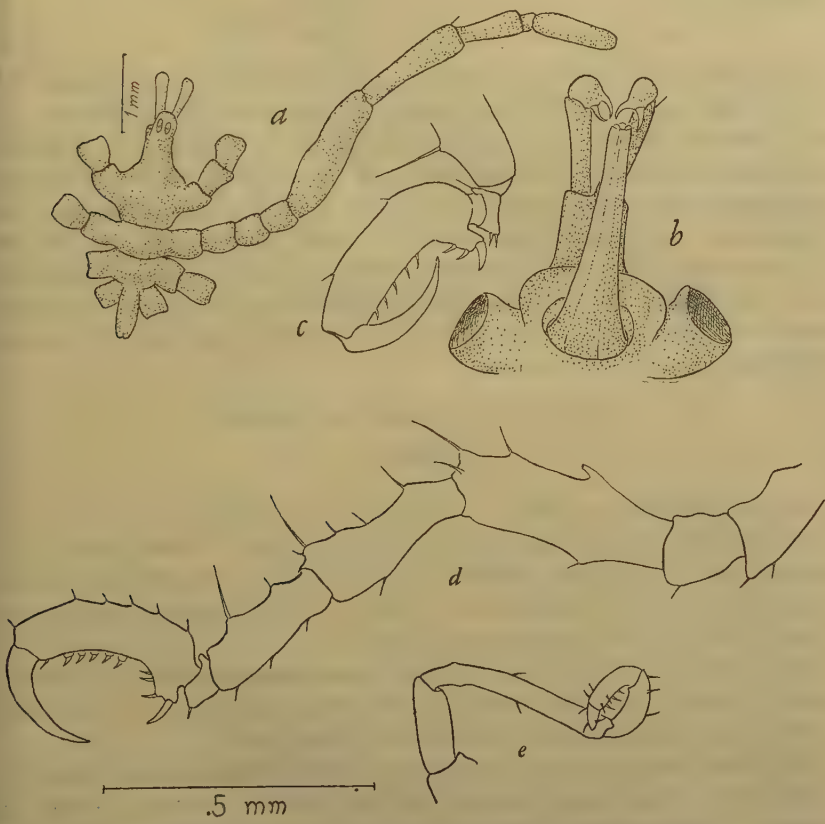

FIGURE 33.—*Anoplodactylus stylirostris*, new species: *a*, Dorsal view of holotype; *b*, ventral view of proboscis and chelifores; *c*, tarsus and propodus; *d*. third leg of male; *e*, oviger.

Cement gland a short narrowly conical tube at an acute angle near middle of femur. Second tibia half or two-thirds as long as first. Tarsus very short, angular, with one or two basal spines. Propodus curved, with a prominent heel, bearing a stout basal spine and two or three shorter spines on its inner margin. Sole with several broad blunt spines. Terminal claw four-fifths as long as propodus; auxiliary claws not apparent.

Oviger: Fourth segment three times as long as fifth and twice as long as second, slightly curved at basal fourth, with a slight swelling near base. Terminal segments sparsely armed with setae.

Measurements (paratype) as follows:

	Mm.	Third leg:	*Mm.*
Proboscis	0.5	Coxae	0.4
Diameter at base	0.2	Femur	0.4
Trunk	0.75	First tibia	0.3
Cephalic segment	0.35	Second tibia	0.25
Second lateral process, width	0.35	Tarsus	0.05
Abdomen	0.15	Propodus	0.3
		Terminal claw	0.2

Remarks.—This species resembles *Anoplodactylus intermedius* Hilton (1942d, pp. 44–45) from Hawaii in its styliform proboscis. It may possibly be the same species, although Dr. Elwood C. Zimmerman, who examined the Hawaiian type for me and compared it with drawings of this form, is of the opinion that they are distinct. The abdomen of this species appears to be about half as long as that of *A. intermedius*, and the eyes are indistinct or lacking in the Hawaiian form, according to Hilton. The styliform proboscis is a curious aberration in a genus in which so many of the females have ventral outgrowths on the proboscis.

ANOPLODACTYLUS PECTINUS, new species

FIGURE 34

Types.—Holotype (male): U.S.N.M. No. 81095, 5 miles south of Loggerhead Key, Tortugas, Fla., July 20, 1924, 7–10 fathoms, W. L. Schmitt coll. Paratype (male): U.S.N.M. No. 81096, off north end of Loggerhead Key, Tortugas, Fla., Aug. 4, 1926, from old rocks and algae, 15 feet, C. R. Shoemaker coll.

Description.—Trunk slender, lateral processes separated by as much as their own diameter. Eye tubercle erect, rounded. Eyes large, near top of tubercle, distinct but lightly pigmented.

Proboscis short, subcylindrical, constricted slightly near the tip.

Chelifore: Scape very slender, sticklike, with a few setae along the outside. Chelae small, fingers slender, bowed, crossing near the tip, without teeth or spinules.

Oviger: Six-jointed, with a nonarticulated segmentation near base of the third segment. Relatively few spines on the terminal joints.

Leg: Slender, free of knobs, tubercles, or prominent setae, except for a low rounded knob at the dorsodistal end of the femur. Femoral cement gland of the cribriform type, at the middle of the joint, depressed and with a transparent rim. Femur and tibiae subequal. Tarsus small; propodus curved but without a prominent heel. There are two basal spines, one simple, the other with denticulations on the inner margin, which give it the appearance of a minute comb. Ventral margin (sole) of propodus with 10 or 11 spines. Terminal claw nearly as long as propodus, almost straight. Auxiliary claws not apparent; if present, they are very small.

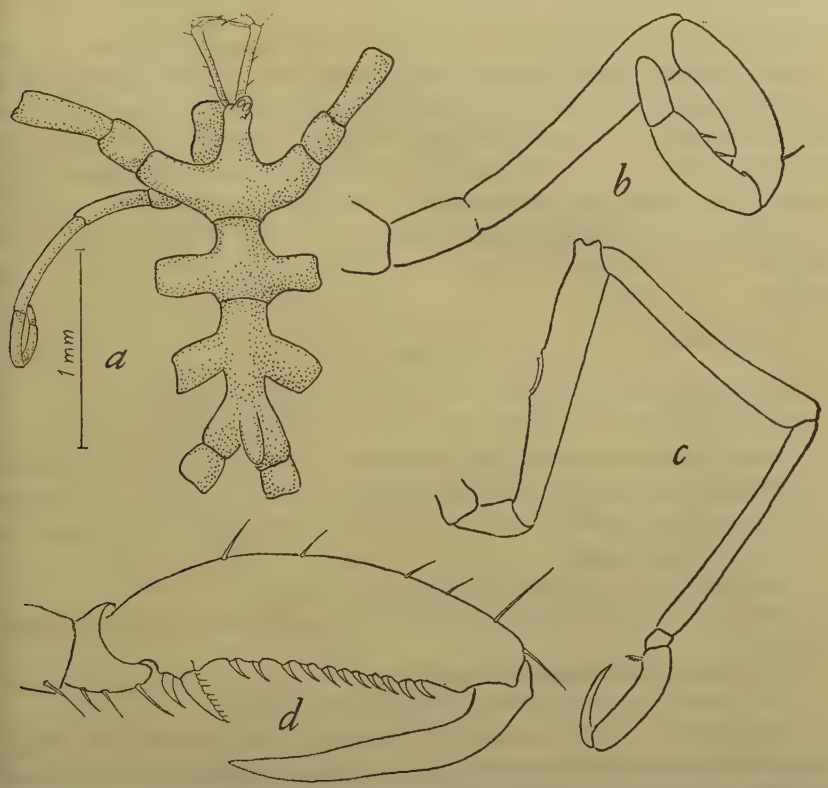

FIGURE 34.—*Anoplodactylus pectinus*, new species: *a*, Dorsal view of holotype; *b*, oviger; *c*, leg; *d*, tarsus and propodus.

Measurements.—As follows:

	Mm.		*Mm.*
Proboscis:		Third leg:	
Length	0. 5	Coxae	0. 5
Diameter	0. 25	Femur	1. 4
Trunk	1. 9	First tibia	1. 3
Cephalic segment	0. 6	Second tibia	1. 25
Second lateral process, width	0. 8	Tarsus	0. 08
Abdomen	0. 25	Propodus	0. 5
		Terminal claw	0. 3

Remarks.—Except for the curious denticulate spine at the base of the propodus and the cribriform type of gland opening, this species resembles *A. pelagicus* Flynn (1928, pp. 25–27), especially in the very slender scape of the chelifore.

ANOPLODACTYLUS sp. A

FIGURE 35

Record of collection.—Loggerhead Key, Tortugas, Fla., August 8, 1930, 10 fathoms, many seaweeds, W. L. Schmitt coll., 1 male (incomplete).

Unfortunately this specimen is without a complete leg, so the structure of the tarsal joints cannot be described. This is probably an undescribed species; the very long and slender tubular gland duct near the distal end of the femur has not been mentioned in other species of the genus. The eye tubercle is tall and erect. The trunk is apparently unsegmented and the integument is very transparent. It is possible that this is a recently molted specimen, but the development of the oviger and femoral gland indicates that it is almost if not quite mature.

ANOPLODACTYLUS sp. B

FIGURE 36

Record of collection.—*Pelican* station 169–7, Jan. 18, 1940, lat. 28°24.5′ N., long. 80°03′ W., 45 fathoms, try net, 1 female.

If not the same species, this specimen is closely related to *Anoplodactylus massiliensis* Bouvier (1916a, 1937). It differs from Bouvier's specimen (also a female), dredged in the Mediterranean off Marseilles, in the following details:

1. The spur on the propodus is about half as long.
2. The eye tubercle is blunt instead of sharply pointed, and there is no evidence of injury.
3. The genital protuberances are very low.
4. The lateral processes are not so widely separated.

Clarification of the status of this specimen must await the collection of males from both sides of the Atlantic. *A. massiliensis* may have as wide a range of variation as *A. insignis;* in fact, such individual variation appears to be the rule in this genus. But the shape and spiny armature of the propodus usually form the most constant feature of the species of *Anoplodactylus*, and the short spur of the

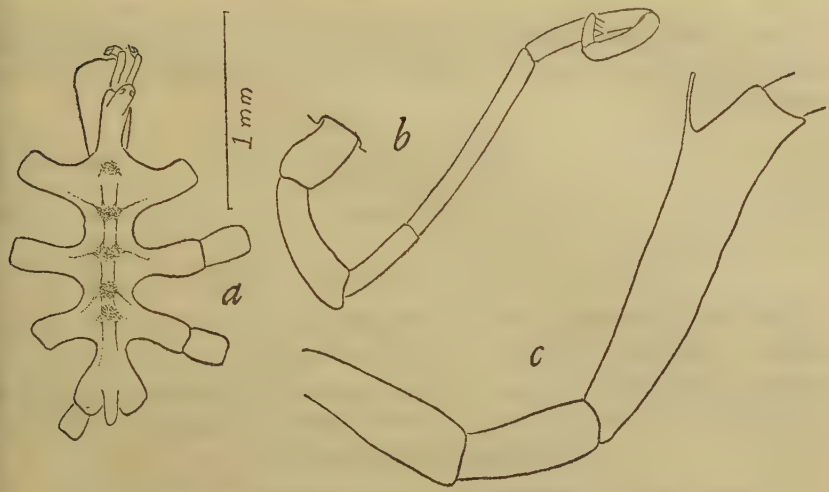

FIGURE 35.—*Anoplodactylus* sp. A: *a*, Dorsal view; *b*, oviger; *c*, femur.

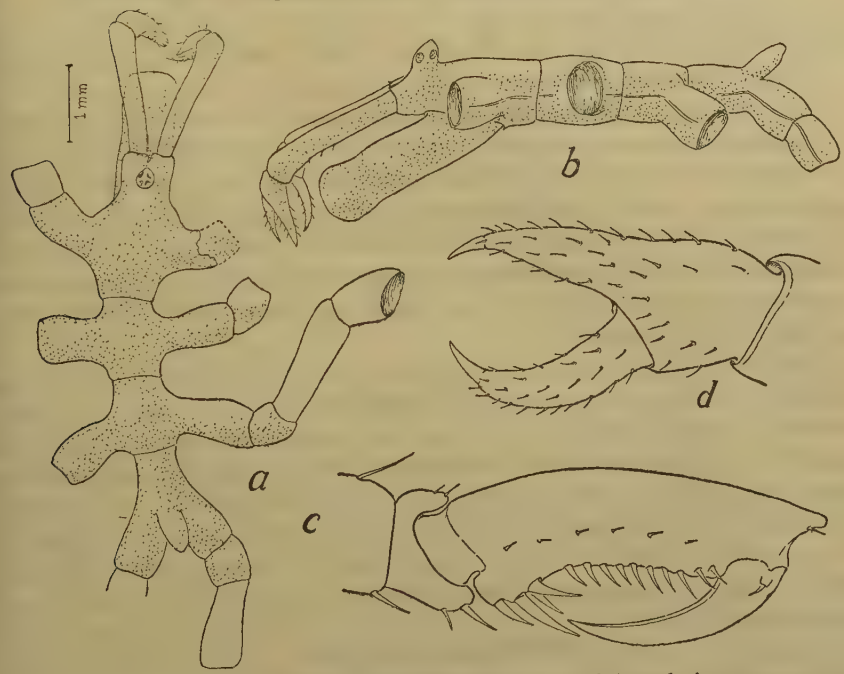

FIGURE 36.—*Anoplodactylus* sp. B: *a*, Dorsal view of female; *b*, lateral view; *c*, tarsus and propodus; *d*, chela.

propodus may separate this specimen from Bouvier's species. Bouvier's figure (1923, fig. 34) is somewhat stylized, and the differences may be more apparent than real. The structure of the chelae is different from those of the other species found in the Caribbean region; the fingers are conspicuously longer than the "palm" or basal part, and the tips are without spines (fig. 36, *d*).

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There is only one entire leg on the specimen. It is without knobs, prominent spines, or other notable features, and has the following measurements:

	Mm.		*Mm.*
First coxa	0.5	Femur	6.0
Second coxa	1.25	First tibia	5.5
Third coxa	0.6	Second tibia	9.0
Tarsus and propodus	1.5		

Family ENDEIDAE Norman, 1908

This family is characterized by the absence of chelifores and palpi, and the presence of ovigers only in the male. The ovigers are 7-jointed. The legs are long, terminating in a well-developed propodus with auxiliary claws. The only known genus is *Endeis*.

Genus ENDEIS Philippi, 1843

(*Phoxichilus* auct. nec Latreille)

Chilophoxus Stebbing, 1902, p. 188.
Endeis Norman, 1908, pp. 231–233.—Cole, 1910, p. 194.—Calman, 1915a, pp. 48–49.—Marcus, 1940b, pp. 71–72.

The unhappy history of this generic name is marked by several impassioned polemics and much spilling of ink (see Pallenidae). As can be seen from the incomplete synonymy given below for *Endeis spinosa*, the matter is still unsettled. This is unfortunate in view of the wide distribution and ecological interest of this species. It seems too much to hope that future specialists will agree on the matter. Marcus is the first to notice that the name *Endeis* requires feminine endings for its species.

Endeis is represented in the northwestern Atlantic by one species, *E. spinosa*, but inasmuch as *E. charybdaea* has been found on the coast of Brazil, it may also be expected in the Caribbean. The only reliable character on which both sexes of the two species may be separated is the larger size of *E. charybdaea;* the length of the body, exclusive of the proboscis, is 8–10 mm., whereas the body of *E. spinosa* is never more than 6.5 mm. in length and is usually less. At best this is an empirical distinction, and *E. charybdaea* seems to be an uncertain species.

ENDEIS SPINOSA (Montagu)

Figure 37

Phallangium spinosum Montagu, 1808, p. 100, pl. 5, fig. 7.
Phoxichilus vulgaris Dohrn, 1881, pp. 169–174, pls. 10, 11.
Phoxichilus spinosus Sars, 1891, pp. 15–20, pl. 1, fig. 3, *a–g*.
Endeis spinosus Norman, 1908, p. 233 (synonymy).—Cole, 1910, pp. 193–203, figs. 1, 2.—Sumner, Osburn, and Cole, 1913, p. 143.
Phoxichilus spinosus Bouvier, 1917, pp. 30–31, pl. 2, fig. 2.
Chilophoxus spinosus Bouvier, 1923, pp. 45–46, figs. 42, 43.—Timmermann, 1932, pp. 327, 333.

Phoxichilus spinosus STEPHENSEN, 1935, p. 30.
Chilophoxus spinosus GILTAY, 1937, p. 89.
Endeis spinosa MARCUS, 1940b, pp. 73–75, fig. 9, *a–e*.—HEDGPETH, 1943b, p. 48.

RECORDS OF COLLECTIONS

Bermuda, 1877. G. Brown Goode coll., 1 female (Y. P. M.).

Bermuda, north shore of St. George Island, June 9, 1936, F. A. Chace, Jr., coll., 1 female (M. C. Z.).

Bermuda, H. Pratt coll., 1 female.

Bermuda, from sargassum, on hydroids, March 17, 1917, W. J. Crozier coll., 1 male, 1 female.

Bermuda, Nonsuch Wharf, Aug. 10, 1937, William Beebe coll., 1 female.

Fish Hawk station 8841, Aug. 22, 1920, off Plantation Point, Chesapeake Bay, 12.8 fathoms, 1 female.

Huntington Island Buoy, 11 miles off coast of South Carolina, March 7, 1935, T. B. Christiansen coll., 1 female.

Tortugas, Fla., June 20, 1905, surface tow, L. J. Cole coll., 1 female (olive-green and light yellow-green).

Tortugas, Fla., Apr. 15, 1906, surface, Gulf Stream, L. J. Cole coll., 1 female.

Tortugas, Fla., Apr. 22, 1906, surface tow, L. J. Cole coll., 1 female.

Tortugas, Fla., May 9, 1906, in floating gulf weed, L. J. Cole coll., 1 male (ov.), 1 female.

Tortugas, Fla., June 5, 1906, 5 fathoms, L. J. Cole coll., fragments.

Loggerhead Key, Fla., northwest of lighthouse, Aug. 4, 1924; 5–10 feet, W. L. Schmitt coll., 1 female.

Shoals north of Loggerhead Key, Tortugas, Fla., 1924, 10–48 feet, W. L. Schmitt coll., 1 female.

North end of Loggerhead Key, Tortugas, Fla., July 14, 1925, W. L. Schmitt coll., 1 male.

Tortugas, Fla., July 28, 1926, from live car under wharf, C. R. Shoemaker coll., 1 male, 1 juv.

Tortugas, Fla., Aug. 18, 1926, from rope hanging in water near wharf, C. R. Shoemaker coll. 5 females.

Johnson-Smithsonian Expedition, station 16, Feb. 3, 1933, north of Puerto Rico, lat. 18°31′ N., long. 66°10′15″ W., 38 fathoms, tangles, 1 male (with *Pentanymphon geayi* Bouvier).

Haiti, Mar. 25, 1927. [Identified from a water-color painting of an ovigerous male, forwarded by William Beebe; the specimen is lost or mislaid.]

Guayanilla Playa Wharf, Ensenada, Puerto Rico, June 25, 1915, on wharf piles 0–5 feet, R. W. Miner and R. C. Osburn colls., 1 male, 1 female.

These specimens vary in extent from 3+ cm. (Bermuda) to less than 8 mm. (Chesapeake Bay), but none of them are as large as *E. charybdaea*. The ovigerous male taken from floating sargassum at Tortugas is about 2.5 cm. in extent. According to Timmermann and Giltay, the specimens taken from sargassum in midocean are of the smaller variety, and the relatively large size of these pelagic specimens is of interest, suggesting that we are not dealing with physiological races or similar specific subdivisions, or at least that the differences are not correlated with habitat.

Distribution.—Sparingly along the European coast from Norway (about lat. 62°30′ N.) to France; in the Mediterranean and Black

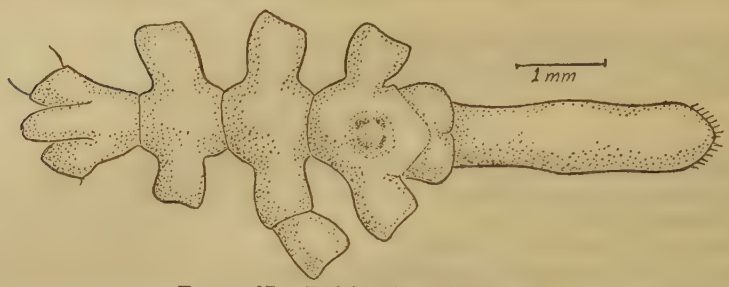

FIGURE 37.—*Endeis spinosa* (Montagu).

Seas (Crimea) and the Azores; Santos Bay and Rio de Janeiro, Brazil. On the North American coast it is apparently common in the Tortugas region. Its occurrence at Woods Hole is sporadic (Cole). The mid-Atlantic records are charted on figures 6 and 7 and will be found in Appendix Table 3. There is one doubtful record from Arctic waters (Schimkewitsch, 1891, p. 514). It is represented in the Woods Hole Oceanographic Institution fouling collections from Panama to Block Island, including the Bahamas, but it is not yet reported from Texas or Louisiana.

Family AMMOTHEIDAE Dohrn, 1881

A family of heterogeneous appearing forms, from the small compact species of *Achelia* to the large spectacular *Ascorhynchus armatus*. Ovigers are present in both sexes, 9- to 10-jointed. Chelifores and palpi present, chelae usually subchelate; palpi 6- to 10-jointed, usually 8- or 9-jointed. At least eight genera are represented in American waters, and the mysterious *Calypsopycnon* is also included in the key.

1. Palpi usually more than 7-jointed; chelifores shorter than proboscis, with small or rudimentary chelae 2
   Palpi 7-jointed; chelifores longer than proboscis, with large chelae opposed in front of mouth ..... **Paranymphon** (p. 253)
2. Propodus intermediate, i. e., without heel and large basal spines and auxiliary claws; proboscis conspicuously large, usually carried ventrally 3
   Propodus with basal spines and usually with auxiliary claws (except *Ephyrogymna*); proboscis not conspicuously large 6
3. Proboscis pyriform or cylindrical but not on a jointed petiole; without large spines on eye tubercle or abdomen 4
   Proboscis pyriform, on a jointed petiole; prominent spines on eye tubercle and abdomen ..... **Eurycyde** (p. 260)
4. Proboscis straight, cylindrical; chelae well developed 5
   Proboscis pyriform, carried ventrally, chelae small or rudimentary. **Ascorhynchus** (p. 253)
5. Scape 1-jointed, trumpet-shaped; terminal claws very long. **Calypsopycnon** (p. 263)
   Scape 2-jointed, chelae large, fingers bowed; terminal claws short. **Heterofragilia** (p. 262)
6. Tibiae without spiny tubercles; scape of chelifores not trumpet-shaped 7
   Tibiae with two rows of tall spinous tubercles; scape trumpet-shaped. **Nymphopsis** (p. 249)

7. Chelifores 3-jointed; trunk segmentation distinct 8
   Chelifores 2-jointed; trunk segmentation usually suppressed. **Achelia** (p. 241)
8. Propodus intermediate; proboscis short, cylindrical .... **Ephyrogymna** (p. 261)
   Propodus well developed; proboscis large, elliptical or pyriform. **Ammothella** (p. 246)

Genus ACHELIA Hodge, 1864

Chelifores 2-jointed, usually subchelate in the adult. Palpi 7- to 9-jointed, usually 8. Oviger 10-jointed, with leaflike denticulate spines but without a large terminal claw. Propodus well developed, with prominent auxiliary claws, but heel and basal spines lacking in some species. The trunk is usually compact and circular, but there are at least two species from deep water with elongate, segmented trunks.

In this genus are included the small forms without a completely segmented trunk which have been referred to *Ammothea* Leach, 1814 (=*Leionymphon* Möbius, 1902) by many authors, or to the subgenus *Achelia* of *Ammothea* by others (Giltay, 1934b). The principal distinction of *Ammothea*, aside from its larger size, is the presence of prominent annular swellings or ridges between the trunk segments. One reason for this confusion has been the apparent mistake in the type locality of *Ammothea carolinensis* Leach (1814, pp. 33–34). Leach believed that the specimens came from South Carolina and named them accordingly. Calman (1915b), in redescribing the holotype, suggested that this may have been an error for South Georgia. Except for dubious records, the genus *Ammothea* s. str. is known only from the Antarctic and sub-Antarctic regions.[23] The only species of pycnogonids so far known from the coast of South Carolina are *Anoplodactylus lentus*, *Endeis spinosa*, *Nymphopsis duodorsospinosa*, and *Tanystylum orbiculare*. *Ammothea carolinensis* has been frequently collected from South Georgia, and there is little doubt that Calman's suggestion is correct.

Helfer, in the Bronn's Tierreich Monograph (Helfer and Schlottke, 1935, p. 284) has confused the matter by first reducing *Achelia* to synonymy under *Ammothea*, then including the genotype of *Ammothea* under the name *Leionymphon* while at the same time recognizing *Ammothea* Leach. As Marcus (1940b, p. 69) has rather pointedly remarked, "Helfer did not comprehend the nomenclature of the Ammotheidae."

There are a number of dubious names, viz, *Alcinous* Costa, 1861, *Phanodemus* Costa, 1836, *Platychelus* Costa, 1861, *Oiceobathys* Hesse, 1867, and *Oomerus* Hesse, 1874, which may be congeneric with *Achelia*, but it seems wisest to forget them. The punctilious taxonomist who endeavors to resurrect such names will not be thanked for his pains.

[23] Loman (1929, p. 71) reports an immature *Ammothea* (*Leionymphon*) from the Atlantic coast of Morocco and Hilton (1943a, pp. 97–98) proposes a new species, *Leionymphon dorsiplicatum*, from the North Pacific.

Achelia is represented in the collections by five species, one of them (*A. brevichelifera*), diverging from the usual form in that the trunk is slender and the lateral processes are widely separated.

1. Lateral processes touching or narrowly separated, body circular 2
   Lateral processes separted by about their own width, body oval in outline ..... **brevichelifera**, new species (p. 245)
2. Heel of propodus with large basal spines; abdomen conspicuously longer than first coxa of fourth leg 3
   Heel of propodus without large basal spines; abdomen not longer than first coxa 4
3. Auxiliary claws at least half as long as terminal claw; lateral processes narrowly separated ..... **spinosa** (p. 242)
   Auxiliary claws less than one third as long as terminal claw; lateral processes contiguous ..... **scabra** (p. 244)
4. Palpus 7-jointed (penultimate twice as long as terminal joint ..... **gracilis** (p. 244)
   Palpus 8-jointed (four terminal joints small) ..... **sawayai** (p. 244)

ACHELIA SPINOSA (Stimpson) Wilson

FIGURE 38, *a*, *b*

Zetes spinosa STIMPSON, 1853, p. 37.
Achelia spinosa WILSON, 1878b, pp. 7–8, pl. 2, fig. 1, *a–h*.
Ammothea achelioides WILSON, 1878b, pp. 16–17, pl. 5, fig. 1, *a–e*.
Achelia spinosa WILSON, 1880, pp. 473–476, pl. 1, fig. 1; pl. 2, fig. 8.
Ammothea achelioides WILSON, 1880, pp. 484–485, pl. 4, figs. 19, 20.
Achelia spinosa WHITEAVES, 1901, p. 262.
Ammothea achelioides WHITEAVES, 1901, p. 203.
Ammothea echinata NORMAN, 1908, p. 224 (part).
Ammothea (*Achelia*) *echinata?* var. *spinosa* SCHIMKEWITSCH, 1930, pp. 133–136.
Ammothea spinosa NEEDLER, 1943, p. 16, fig. 20, *a–d*.

Record of collection.—St. Croix River between station toward Joes Point, St. Andrews, New Brunswick, August 1913 (dredging), R. W. Miner coll., 1 male (AMNH).

This species is not often collected; there is no material in the collections of the National Museum and the Peabody Museum collected since Wilson's day. Hence there is little to add to the range established by Wilson (1880), namely, from Long Island Sound (Block Island) to Eastport, Maine, and Grand Manan, except this New Brunswick record.

The spiny processes of the first coxal joints which are characteristic of this species vary somewhat in size and number. This variation is not correlated with sex. Dorsal tubercles on the lateral processes are developed in a few of the specimens, similar to those found in *A. scabra*, but they are shorter. The auxiliary claws are always long.

Norman and several later writers have suggested that *A. spinosa* is the same as *A. echinata* Hodge, 1864. If so, the name *spinosa* has priority over *echinata*. Wilson (1880) examined some specimens of *A. echinata* and summarized their differences from *spinosa* as follows: "[*A. echinata*] has a slender, tapering rostrum (proboscis) of a very different shape; the peculiar conical spinous tubercles

upon the legs are much more numerous, large and more slender; the abdomen is much shorter and stouter. Moreover, in *A. echinata* the second joint, in at least the two posterior pairs of legs, has a very prominent, rounded, hair tubercle, projecting from the lower and posterior side, which is wanting in our species." Reexamination of some of Wilson's material has revealed the presence of very low genital protuberances on the last two pairs of second coxae in the males of *spinosa*, but they are far from prominent. Until the larval development of the two species can be compared, this difference alone is enough to entitle them to separate names.

Hilton (1943a, pp. 94–95) lists *Ammothea echinata* from San Francisco Bay and Alaskan waters. This cannot be *Achelia spinosa*, since "two well developed suture lines" are mentioned; *A. spinosa* has an unsegmented trunk.

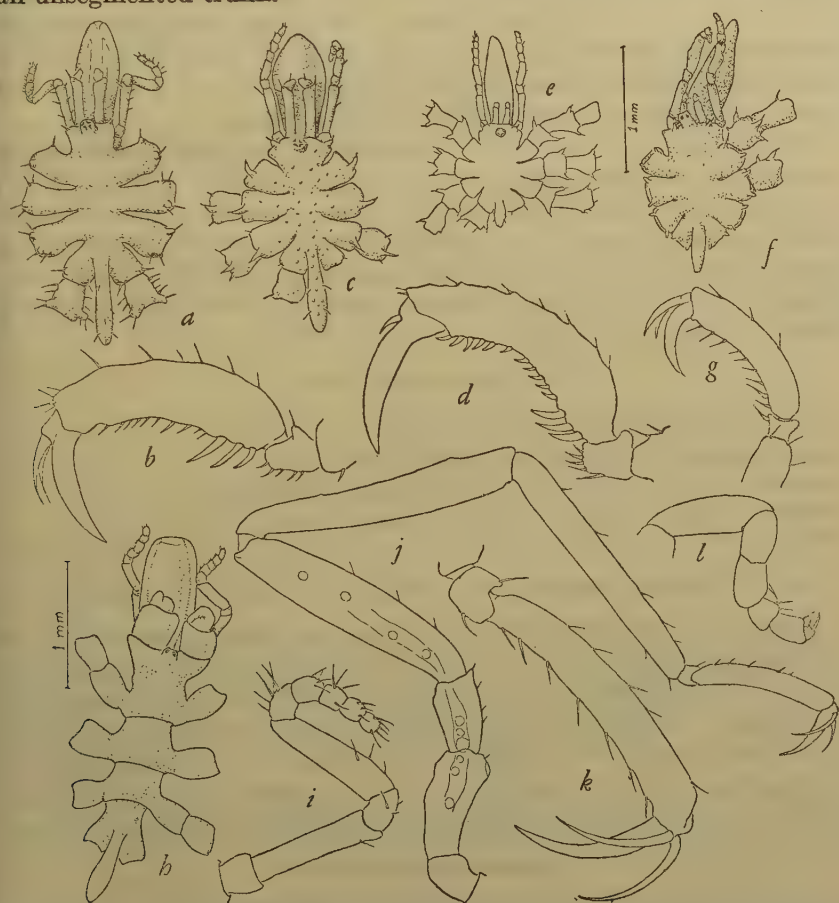

FIGURE 38.—*a*, *b*, *Achelia spinosa* (Stimpson) Wilson; *c*, *d*, *A. scabra* Wilson; *e*, *A. sawayai* Marcus; *f*, *g*, *A. gracilis* Verrill; *h–l*, *A. brevichelifera*, new species: *h*, Dorsal view of holotype; *i*, palpus; *j*, leg; *k*, tarsus and propodus; *l*, terminal joints of oviger.

Ammothea achelioides is an immature form of *A. spinosa* in which the chelifores are still chelate.

ACHELIA SCABRA Wilson

FIGURE 38, *c, d*

Achelia scabra WILSON, 1880, pp. 475–476.—GILTAY, 1942, p. 460.
Ammothea scabra NEEDLER, 1943, p. 16, fig. 21, *a–c*.

RECORDS OF COLLECTIONS

South of Cape Sable, Nova Scotia, Oct. 7, 1908, 45 fathoms, Owen Bryant coll., 2 females.

Off Grand Harbor, Grand Manan, August 1910, H. L. Clark and H. B. Bigelow colls., 1 male (M.C.Z.).

Wilson's description of this species is based on two specimens which he had previously mistaken for *A. spinosa*, a male from off Cape Ann and a female from St. Georges Bank. Two more females were found, in reexamining the material, in a vial identified as *A. spinosa*, from Casco Bay, 1873. Giltay's record (*Prince* station 43) extends the range of this species to the Gulf of St. Lawrence.

Achelia scabra differs from *A. spinosa* in the reduction of spiny tubercles on the first coxae, the presence of large tubercles on the posterior outer corners of the lateral processes, and the reduced length of the auxiliary claws. The specimen from Grand Manan has a few more spines on the first coxae than seem to be usual for this species. In none of the specimens of *spinosa* or *scabra* could I find auxiliary claws of transitional length.

ACHELIA GRACILIS Verrill

FIGURE 38, *f, g*

Achelia (?) *gracilis* VERRILL, 1900, p. 582, pl. 70, fig. 10.
Ammothea gracilis COLE, 1904b, pp. 317–323, pl. 21, figs. 4–14.
Ammothea (*Achelia*) *gracilis* GILTAY, 1934b, p. 5.
Achelia gracilis MARCUS, 1940b, p. 79.

Record of collection.—Bermuda, July 8, 1905, from *Pennaria*, 10 specimens.

Although Giltay gives the Bahamas as the further distribution of this species, there is no material in the museum collections from that region. Giltay's record may be founded on unreported material in the Belgian Museum or on National Museum material which has since been mislaid. It is evidently common at Bermuda and is represented in the Woods Hole Oceanographic Institution fouling collections from station G12, Port Everglades, Fla., August 16, 1943.

ACHELIA SAWAYAI Marcus

FIGURE 38, *e*

Achelia sawayai MARCUS, 1940b, pp. 81–86, figs. 10, *a–f*, 17.

RECORDS OF COLLECTIONS

Albatross station 2379–74, Feb. 1885, Gulf of Mexico, south of Cape St. George, about 25 fathoms, 1 male (ov.), 1 female.

Southwest of Loggerhead Key, Tortugas, Fla., July 31, 1926, about 15 feet, from old rocks and algae, C. R. Shoemaker coll., 1 male (ov.), 1 female.

Off northern end of Loggerhead Key, Tortugas, Fla., Aug. 4, 1926, about 15 feet, from old rocks and algae, C. R. Shoemaker coll., 1 male (ov.).

North end of Loggerhead Key, Tortugas, Fla., Aug. 13, 1926, in shallow water, from old rocks and algae, C. R. Shoemaker coll., 1 male.

Velero III, station A 15–39, Apr. 8, 1939, outside Bahia Honda, Colombia, 8–9 fms., corallines, 1 male.

Velero III, station A 32–39, Apr. 15, 1939, 3 miles north of Coche Island, Venezuela (10°50′30″N., 63°54′30″ W.), 21–35 fathoms, sand and shell, 1 male, 1 juv., fragments.

Like *Achelia gracilis*, *A. sawayai* does not have large spines on the propodus. It is smaller and more spinous than *gracilis*. The 8-jointed palpus separates it clearly from *gracilis*.

This species is found frequently in the vicinity of Bahia de Santos and Itanhaen, Brazil; these are the first records outside those localities. Marcus (1940b, p. 118ff, fig. 17), has described the larval stages of this species in considerable detail.

ACHELIA BREVICHELIFERA, new species

FIGURE 38, *h–l*

Types.—Holotype (female): U.S.N.M. No. 81097, *Fish Hawk* station 1028, September 14, 1881, lat. 39°57′ N., long. 69°17′ W., 410 fathoms. Paratype (female): U.S.N.M. No. 81098, *Albatross*, station 2212, Aug. 23, 1884, lat. 39°59′30″ N., long. 70°30′45″ W., 428 fathoms.

Description.—Trunk: Oval in outline, completely segmented, lateral processes separated by about their own width. Eye tubercle at anterior edge of cephalic segment, small, blunt, with small eyes.

Abdomen: As long as cephalic segment, slightly swollen distally and tapering to a bluntly rounded tip.

Proboscis: As long as first two trunk segments, broadly elliptical, blunt at tip.

Palpus 9-jointed, first and third joints about as long as broad, second and fourth subequal and about five times as long as first joint, joints 6 to 9 small, with a few large spines on each joint.

Chelifore: Scape as broad as long, chela half as long as scape, cuspid at tip.

Oviger: Third and fifth joints subequal, twice as long as fourth. Sixth to tenth joints diminishing in size; terminal joints with a few simple spines.

Leg: Long, slender, with a few scattered spines. Tarsus not much longer than wide, propodus long, slightly curved and with 6 or 7 widely separated spines on the sole. Terminal claw about half as

long as propodus, auxiliary claws nearly four-fifths as long as terminal claw.

Measurements.—As follows:

	Mm.
Proboscis	0.9
Cephalic segment	0.5
Trunk	1.5
Abdomen	0.5

Third leg:	*Mm.*
First coxa	0.4
Second coxa	0.9
Third coxa	0.5
Femur	1.98
First tibia	2.2
Second tibia	2.1
Tarsus	0.1
Propodus	1.1
Terminal claw	0.5
Auxiliary claw	0.4

Remarks.—This species is distinct from the fifty-odd other members of the genus because of its widely separated lateral processes. Denticulate spines could not be made out on the spines of the terminal segments of the oviger but may be present in the male, which is still unknown. It is evidently a deep-water (400 fathoms) species; most of the species of *Achelia* are littoral. Hilton (1943a, p. 96) gives a preliminary diagnosis for a species (*Ammothea elongata*) with an "elongate" body and slender legs with spines, from the North Pacific at 695 fathoms.

Genus AMMOTHELLA Verrill, 1900

Ammothella Marcus, 1940b, pp. 88–89.

Chelifores 3-jointed, achelate in adult. Palpi 9-jointed. Oviger 9-jointed, with denticulate spines on terminal segments. Legs long, slender, propodus well developed, with basal spines.

According to Marcus, who has examined specimens and larval stages, *Ammothella appendiculata* and *A. rugulosa* are distinct species. The adults differ principally in the distribution of club-shaped spines. In *rugulosa* these spines are found on the basal joint of the scape of the chelifore and usually on the anterior edge of the cephalic segment over the insertion of the palpus. These club-shaped spines are never found on the basal segment of the chelifore in *appendiculata* or on the lateral processes. These relatively minor differences are supported by differences in the Protonymphon larva: the larva of *appendiculata* is larger and the fingers of the chelae are longer in proportion to the palm than those of *rugulosa*.

Ammothella appendiculata (Dohrn) occurs in the Mediterranean and at Rio de Janeiro, Brazil. It is not represented in the museum collections from North American waters.

1. Without barbed, plumed spines on chelifores; lateral processes and first coxae without lateral spurs 2
   Barbed spines resembling minute feathers on chelifores; lateral processes and first coxae with lateral spurs ..... **marcusi**, new species (p. 247)

2. Clubbed spines present on basal segment of scape and lateral processes. **rugulosa** (p. 247)

Clubbed spines absent from basal joints of scape and lateral processes. **appendiculata** (Dohrn, 1881)

AMMOTHELLA RUGULOSA (Verrill)

FIGURE 39, *a*

Ammothea (*Ammothella*) *rugulosa* VERRILL, 1900, p. 581, figs. 2, 3, pl. 70, fig. 90.
Ammothea appendiculata COLE, 1904b, pp. 323–324, pl. 21, figs. 15–18; pl. 22, figs. 19, 20.
Ammothella rugulosa MARCUS, 1940b, pp. 92–93, fig 12, *a–g*.

RECORDS OF COLLECTIONS

Biscayne Bay, Fla., Jan. 27, 1947, from fouling on vessel bottom, F. M. Bayer coll., 1 male (ov.), 2 females (Univ. Miami).

Fort Jefferson, Tortugas, Fla., Aug. 4, 1924, washed from seaweed, moat near intake pipe, W. L. Schmitt coll., 1 male, 1 female.

East side of Loggerhead Key, Tortugas, Fla., July 28, 1924, W. L. Schmitt coll., 1 specimen.

Tortugas, Fla., July 24, 1930, from seaweed, W. L. Schmitt coll., 1 male.

This small pycnogonid is difficult to examine because of the debris usually found on the surface of the body and on the legs among the numerous spines. The club-shaped spines are about half as long as the unspecialized type on the chelifores and about half as long as the diameter of the scape. Clubbed spines are present over the insertion of the palps in some of the specimens, lacking in others. When there is no clubbed spine over the palpi, there may be a small projecting tubercle instead.

Distribution.—Bermuda, southeastern Florida, Tortugas, Bahia de Santos and Itanhaen, Brazil. A littoral species.

AMMOTHELLA MARCUSI, new species

FIGURE 39, *b–g*

Holotype (*male*).—U.S.N.M. No. 81099, northeast end of Loggerhead Key, Tortugas, Fla., August 6, 1926, about 15 feet, from old rocks and algae, C. R. Shoemaker coll.

Description.—Trunk oval in outline, lateral processes slightly spread distally, with prominent lateral spurs on anterior and posterior corners. Eye tubercle tall, erect, with a small tubercle on its apex. Eyes large, near top of tubercle.

Proboscis about as long as trunk, pyriform.

Abdomen slender, arched, as long as last three trunk segments, slightly swollen distally, and with three ranks of spines.

Palpus slender, the terminal joints considerably longer than wide.

Chelifore slender, basal joint of scape nearly as long as second, chelae rudimentary. Armed with long slender hollow spines and a few minutely barbed spines (fig. 39, *f*).

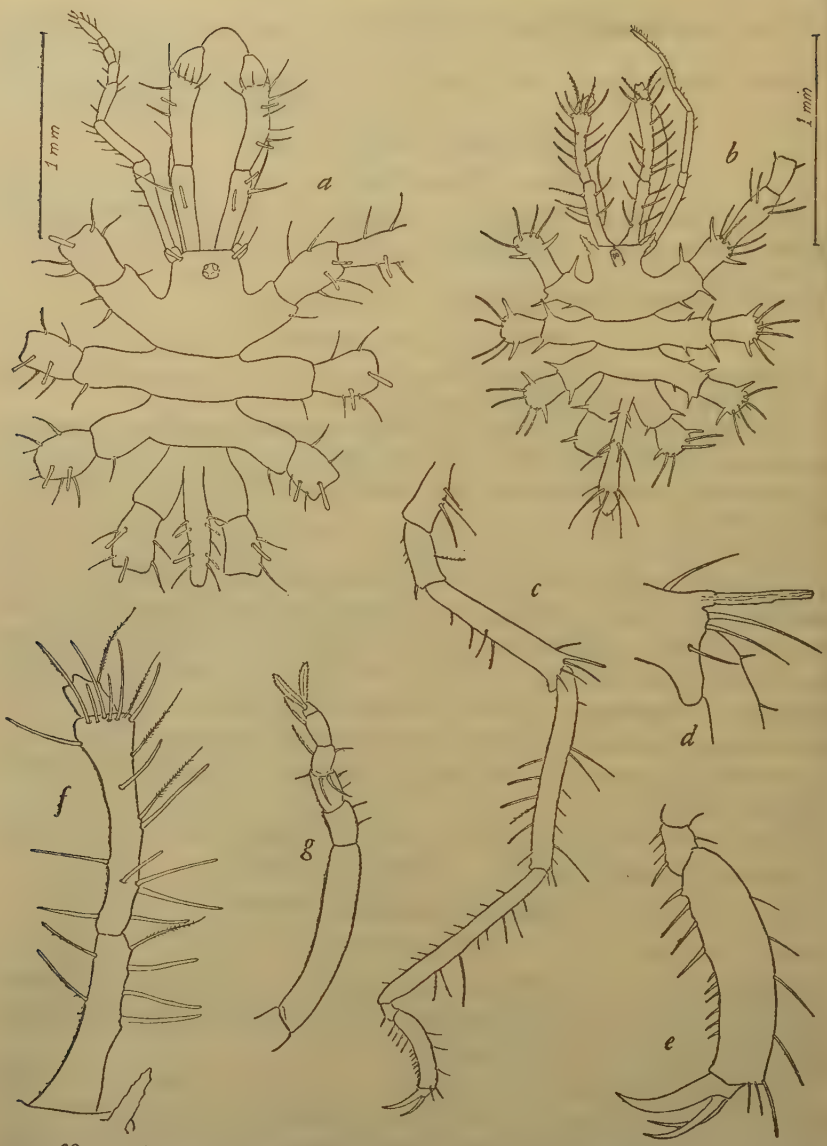

FIGURE 39.—*a*, *Ammothella rugulosa* (Verrill); *b–g*, *A. marcusi*, new species: *b*, Dorsal view of holotype; *c*, leg; *d*, distal end of femur showing duct of cement gland; *e*, tarsus and propodus; *f*, chelifore; *g*, terminal joints of oviger.

Oviger: Terminal joints small, with a few denticulate spines. The two large leaflike spines on the terminal joint are considerably longer than the joint.

Leg: First and third coxae subequal, second about half again as long as first. No genital processes apparent on second coxa. Femur shorter than first tibia, first tibia shorter than second. Tarsus very

short, propodus slightly curved, with four large, straight, widely separated basal spines. Auxiliary claw about three-fourths as long as terminal claw.

Measurements.—As follows:

	Mm	Third leg:	*Mm*
Proboscis	ca. 0.75	First coxa	0.2
Trunk	0.75	Second coxa	0.3
Second lateral process, width	0.75	Third coxa	0.25
Chelifore	0.7	Femur	0.75
Abdomen	0.6	First tibia	0.9
		Second tibia	1.0
		Tarsus	0.08
		Propodus	0.4
		Terminal claw	0.2
		Auxiliary claw	0.18

Remarks.—This species is smaller than *A. rugulosa*, is more spiny in appearance, and has lateral spurs on the first coxae and lateral processes. The barbed spines on the chelifore and, sparingly, on the coxae, femur and first tibia should distinguish *A. marcusi* from other species in the genus, but they are not easy to see in such a small animal. Also of specific importance are the serrated tubercle over the insertion of the palpus and the long, spinelike femoral cement gland tube.

This species is dedicated to Dr. Ernesto Marcus, of the Departamento de Zoologia of the Universidade de São Paulo, Brazil, in recognition of his excellent work with South American pycnogonids and in commemoration of a delightful correspondence.

Genus NYMPHOPSIS Haswell, 1884

Nymphopsis WILLIAMS, 1933, pp. 173–180.

Chelifores 2- or 3-jointed, achelate; scape usually trumpet-shaped. Palpi 9-jointed. Ovigers 10-jointed. Legs rather heavy, armored in most species, with large compound spines and spiny tubercles, propodus well developed.

This genus is represented in the Caribbean region by two species, *Nymphopsis anarthra* and *N. duodorsospinosa*. Since Williams drew up a key to the genus, three more species have been referred to it, and the following key is based on a somewhat different series of characters:

1. Scape of chelifores 1-jointed 2
   Scape 2-jointed 3
2. Dorsal trunk tubercles small, shorter than eye tubercle (Queensland). **armata** Haswell (1884)
   Dorsal trunk tubercles taller than eye tubercle (Venezuela) ..**anarthra** (p. 250)
3. Dorsal trunk tubercles present 4
   Without dorsal trunk tubercles (Timor) ....**korotnewi** Schimkewitsch (1888)

4. Three dorsal trunk tubercles 7
   Two dorsal trunk tubercles 8
5. Without trunk segmentation; numerous compound spines 6
   Cephalic segment separated by suture; without compound spines (Falkland Islands) ..... **denticulata** Gordon (1932)
6. Auxiliary claws minute (Tortugas, South Carolina, Baja California, Galápagos) ..... **duodorsospinosa** (p. 250)
   Auxiliary claws one third as long as terminal claw (East Indies, Japan). **muscosa** Loman (1908)
7. Without terminal spines on dorsal trunk tubercles 8
   Large terminal spine on trunk tubercles (Capetown) .. **abstrusa** Loman (1923)
8. Auxiliary claw well developed; processes on tibial joints confined to proximal half (Queensland) ..... **acinacispinatus** Williams (1933)
   Auxiliary claws minute; processes on tibial joints generally distributed (California) ..... **spinosissima** (Hall, 1912)

NYMPHOPSIS ANARTHRA Loman

Nymphopsis anarthrus Loman, 1928a, pp. 39–42, 1 fig.

This species is not represented in the collections examined. It differs from the following species in having a 1-jointed scape and in having dorsal trunk tubercles which are noticeably taller than the eye tubercle. Loman's inadequate figure suggests a different arrangement of spiny tubercles on the tibiae, especially the lack of a saddle or bare spot on the middle of the first tibia, and a longer abdomen. *Nymphopsis anarthra* was collected from Tortuga Island, north of Venezuela.

NYMPHOPSIS DUODORSOSPINOSA Hilton

Figure 40

Nymphopsis duodorsospinosa Hilton, 1942b, pp. 303–305, pl. 45.

RECORD OF COLLECTIONS

Folly River, S. C., Apr. 24, 1935, G. R. Lunz coll., 1 male, 1 female.

Tortugas, Fla., June 1908, 8–10 fathoms, among Bryozoa, L. J. Cole coll., 1 female.

Identification of these specimens was confirmed by direct comparison with the type specimens, from which they differ only in their slightly smaller size and shorter abdomen.

Description (based on type material and Atlantic specimens)[24].—

Trunk: Broadly oval in outline, lateral processes well separated. Dorsal trunk tubercles two, covered with small spines but not sharply pointed and without a terminal spine, about the same height as the eye tubercle. Eye tubercle erect, about twice the diameter of the trunk tubercles, truncate at tip. Eyes distinct, near apex. On the median dorsal end of each lateral process is a low spiny tubercle, it is inconspicuous on the last pair of lateral processes.

[24] Hilton, 1942b, p. 304, designates a female as the type, but the "holotype" now at the Allan Hancock Foundation of the University of Southern California, is a male.

Proboscis ovoid, blunt at tip, about as long as the trunk, directed ventrally.

Abdomen about as long as trunk, erect but arched, with three pairs of large dorsal spines, some of them compound.

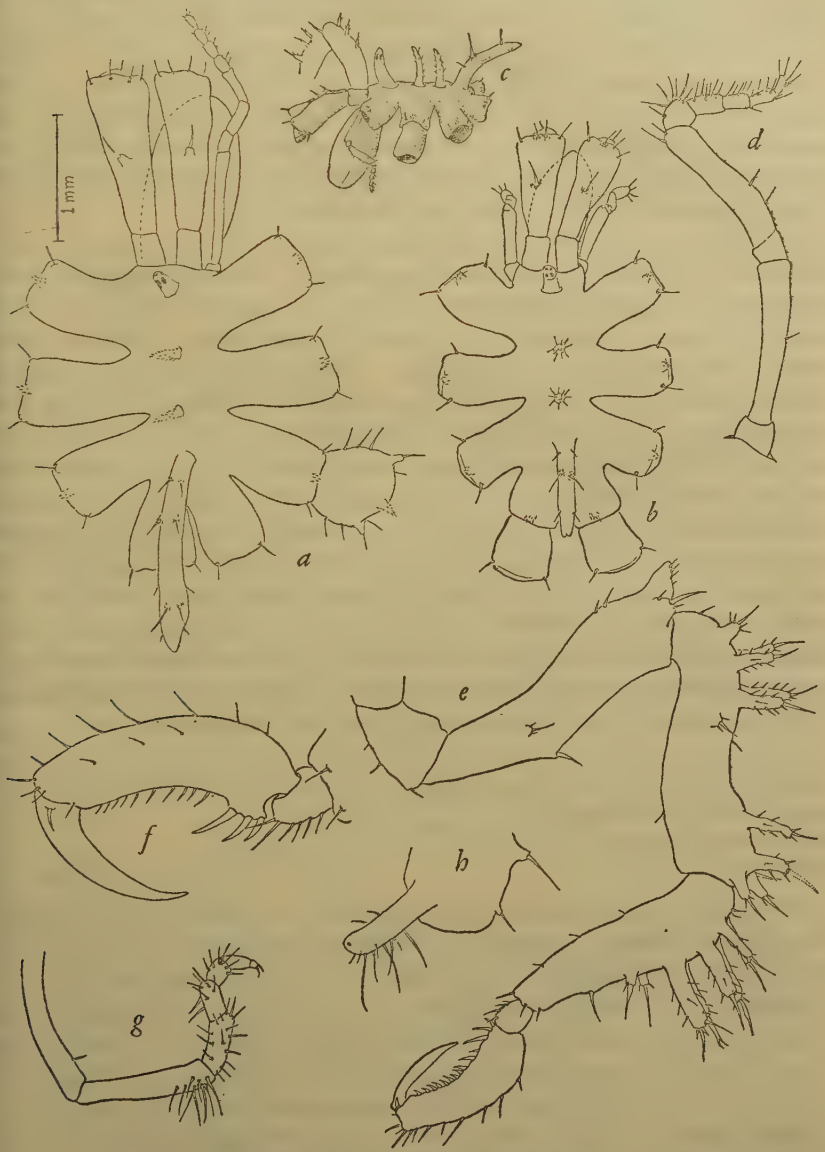

FIGURE 40.—*Nymphopsis duodorsospinosa* Hilton: *a*, Dorsal view of holotype; *b*, dorsal view of South Carolina specimen (female); *c*, dorsolateral view of same specimen; *d*, palpus; *e*, leg; *f*, tarsus and propodus of paratype; *g*, oviger of male; *h*, genital process of holotype.

Chelifore 3-jointed, first joint about one-fourth as long as second. Second joint trumpet-shaped, with a fringe of spines around the distal rim, and a large spine on a low tubercle at about the middle of the joint. Chela globular, hidden in the end of the scape.

Palpus 9-jointed, first, third, and fifth joints subequal, second joint longer than fourth. Terminal joints diminishing in size, spinose.

Oviger 10-jointed, fourth and fifth joints longest, Male: A cluster of spines at the end of the fifth joint, joints 6 to 8 spinose. Ninth joint without spines, tenth very small, with two hooklike terminal spines which may have minute denticulations. Female: Fifth joint without spines, joints 6 to 9 subequal, with two rows of spines on the ventral surface. Tenth joint as in the male.

Leg stout, flexed in preserved specimens. The first coxa of the male is more spiny than that of the female. The male genital protuberance is fingerlike, about four times as long as its diameter, and bears a number of spines on its distal half which are about twice as long as the diameter of the process. The female process is shorter, broader, and without spines. Femur relatively free of dorsal spines, but with a series of large spines at about the middle of the joint, one on each side and one ventrally (not two spines along the ventral margin as figured by Hilton). Tibiae armed with a series of tall spinous tubercles with long terminal spines. On the first tibia these tubercles are clustered at both ends, and on the second they are restricted to the proximal half of that joint. Tarsus very short, with slender spines ventrally. Propodus slightly curved, with three heavy basal spines, and 10 or 11 spines on the sole. Terminal claw about three-fourths as long as propodus, auxiliary claws very small, but distinct.

Measurements.—As follows (leg flexed, not measured):

	Mm.
Proboscis	ca. 2.0
Trunk	2.0
Second lateral process, width	2.5
Abdomen (from above)	1.6
Chelifore	1.6

Remarks.—The differences between the abdomen of the holotype and South Carolina specimens are slightly exaggerated by the perspective in the figures; but they are not of specific significance.

Distribution.—As indicated in the key, this species is found on both Atlantic and Pacific coasts, at Tortugas and South Carolina on the Atlantic side of North America, and at the Galápagos and Baja California on the Pacific side of the continent. It is evidently a sublittoral species. Hilton lists it from shore at the Galápagos and at 26 fathoms from San Francisquito Bay, Baja California.

Genus PARANYMPHON Caullery, 1896

Palpi 7-jointed. Chelifores chelate, scape 1-jointed. Ovigers 10-jointed. Trunk unsegmented. Genital pores were observed in the second coxa of the last three pairs of legs in the females; in the males they could be found only on the last legs. There is only one known species.

PARANYMPHON SPINOSUM Caullery

FIGURE 41

Paranymphon spinosum CAULLERY, 1896, p. 361, pl. 12, figs. 1–6.—MEINERT, 1899, pp. 46–47, pl. 4, figs. 20–28.—NORMAN, 1908, pp. 222–224, pl. 30, figs. 10–14.—BOUVIER, 1917, p. 17, pl. 3, figs. 3–6.—STEPHENSEN, 1933, p. 6.

FISH HAWK RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
894	Oct. 2, 1880	39 53 00	70 58 30	365	2
1093	Aug. 11, 1882	39 56 00	69 45 00	349	1

ALBATROSS RECORDS

2203	Aug. 19, 1884	39 34 15	71 41 15	705	1
2214	Aug. 22, 1884	39 57 00	70 32 00	475	2
2547	Aug. 8, 1885	39 54 30	70 20 00	390	2
2680	July 16, 1886	39 50 00	70 26 00	555	1 (ov. ♂).

The peculiar stellate processes on the body integument described by Norman were not evident in this material. The local bathymetric range falls within that given by Stephensen, 385–2,300 meters.

Distribution.—A North Atlantic Basin species, south of latitude 35°. These are the first published records from the western Atlantic.

Genus ASCORHYNCHUS Sars, 1877

Barana DOHRN, 1881, p. 123.
Scaeorhynchus WILSON, 1881, p. 247.

Chelifores 2- or 3-jointed, chelae subchelate or minute pincers. Palpi 9-jointed. Oviger 8- or 9-jointed, with terminal claws. Propodus intermediate, without heel and basal spines; or tapering. Proboscis large, pyriform, usually carried ventrally.

Represented in western North Atlantic waters by four species:

1. Tarsus short, propodus intermediate, with spines on sole 2
   Tarsal joints tapering; large abyssal species ..... **armatus** (p. 255)
2. Scape 1-jointed, without tall, pointed trunk tubercles 3
   Scape 2-jointed; dorsal trunk tubercles tall and pointed.
   serratum, new species (p. 259)

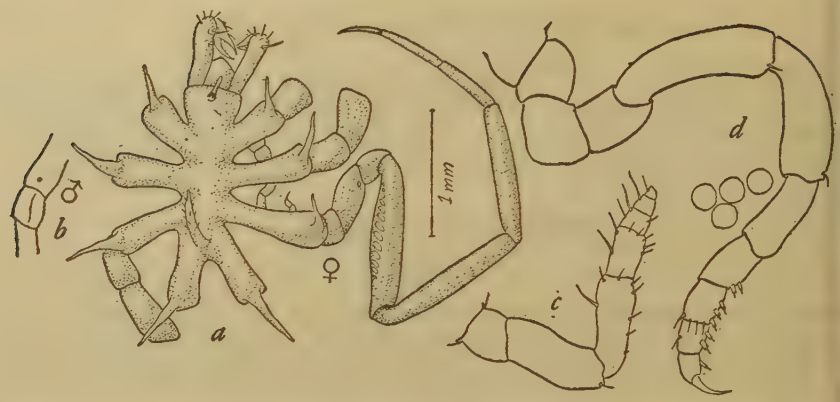

FIGURE 41.—*Paranymphon spinosum* Caullery: *a*, Dorsal view of female; *b*, genital pore of male; *c*, palpus; *d*, oviger.

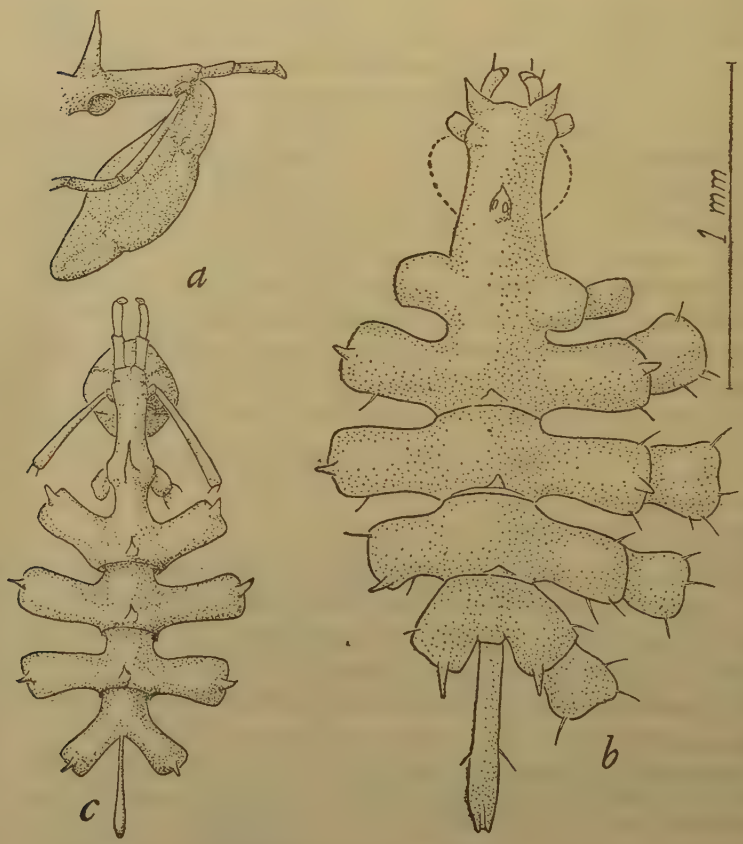

FIGURE 42.—*a*, *Ascorhynchus armatus* (Wilson); *b*, *A. latipes* (Cole).

. Lateral processes not separated by their own diameter; scape shorter than neck. **latipes** (p. 256)

Lateral processes separated by their own diameter; scape as long as neck. **colei** (p. 257)

ASCORHYNCHUS ARMATUS (Wilson)

FIGURES 42, *a*; 43

Scaeorhynchus armatus WILSON, 1881, pp. 248–249, pl. 2, figs. 3, 4; pl. 5, figs. 26–31.—VERRILL, 1885, p. 560, fig. 171.

Ascorhynchus agassizi BOUVIER, 1937, p. 38.

Ascorhynchus armatus HEDGPETH, 1943b, pp. 49–50.—NEEDLER, 1943, p. 15, fig. 19, *a-e*.

ALBATROSS RECORDS

tation No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2074	Sept. 3, 1883	41 43 00	65 21 50	1,309	6
2077	Sept. 4, 1883	41 09 40	66 02 20	1,255	2
2084	Sept. 5, 1883	40 16 40	67 05 15	1,290	1
2205	Aug. 20, 1884	39 35 00	71 18 45	1,073	2
2706	Aug. 27, 1886	41 28 30	65 35 30	1,188	2
2725	Oct. 24, 1886	36 34 00	73 48 00	1,374	2
2731	Oct. 25, 1886	36 45 00	74 28 00	781	1

About half of this material was sent to me for examination; the specimens are all large (about 15 cm. in extent) and show little variation. Wilson's description of the male oviger is brief and unsupported by a figure.

Ascorhynchus agassizi Schimkewitsch (1893, pp. 36–39) from the Pacific side of the Isthmus of Panama is very close to *A. armatus*, especially to the smaller specimens taken in relatively shallow water north of Cuba. Some of these specimens, as I have previously noted, are minutely setose and have small chelae. The principal difference between the Atlantic and Pacific species seems to be in the structure of the male oviger. According to the figure given by Schimkewitsch (*loc. cit.*, pl. 2, fig. 13), the hairs in the tuft at the end of the sixth joint of *A. agassizi* are heavier and differently arranged than in *A. armatus*. Also, the denticulate spines on the terminal segments appear to be shorter and thicker in *A. agassizi*. These differences may be the fault of the artist or the angle from which the structure was examined. All the known male specimens of *A. agassizi* are types and unavailable to me for examination.

Bouvier's identification of *Ascorhynchus agassizi* from the west coast of Africa is probably an error for *A. armatus*. It is published without comment as to its size or general appearance. Possibly the specimen is of the smaller type as taken by the *Atlantis* north of Cuba. This record would indicate that the species is generally distributed in the North Atlantic Basin.

ASCORHYNCHUS LATIPES (Cole)

FIGURE 42, *b*

Barana latipes COLE, 1906a, pp. 217–22, pls. 1, 2.
Ascorhynchus latipes MARCUS, 1940b, p. 93.

RECORD OF COLLECTIONS

Tortugas, Fla., 1924, W. L. Schmitt coll., 1 male.

Bird Key Reef, Tortugas, Fla., July 31, 1924, from rocks, south end, W. L. Schmitt coll., 1 female.

Key West, Fla., 2 feet, from Peabody Acad. Sci., 1 male, 1 female (M.C.Z.).

Piedra Priata Reef, Barahona Harbor, Dominican Republic, August 17, 1933, in breakers (2 feet, station 226), J. C. Armstrong coll., 20 specimens (including ovigerous male) (A.M.N.H.).

Piedra Priata Reef, north of sand spit, Barahona Harbor, Dominican Republic, August 8, 1933 (1–2 feet, station 203), J. C. Armstrong coll., 1 male (A.M.N.H.).

FIGURE 43.—*Ascorhynchus armatus* (Wilson): Terminal joints of oviger (male).

A small littoral species, from the Bahamas and Florida to southern Hispaniola. It is about 15–20 mm. in extent, with close-set lateral processes and spiny legs. This species superfically resembles *A. arenicola* (Dohrn), which occurs on the Atlantic coast of Morocco, but is actually quite different. The forward prolongation or neck of

the cephalic segment is much shorter than the scape, and the lateral processes are more widely separated in *A. arenicola*.

ASCORHYNCHUS COLEI Hedgpeth

FIGURE 44, *g–k*

Ascorhynchus colei HEDGPETH, 1943b, p. 50 (diagnosis).

Types.—Holotype (female): U.S.N.M. No. 81100, American Shoal Light bearing Northeast by North 8 miles, Pourtalès Plateau, 70–80 fathoms, State University of Iowa Bahamas Expedition 1893, Station 62. Paratypes: One female, U.S.N.M. No. 81103, same locality; 1 male, 1 female, M.C.Z. No. 12233, off Sombrero Key, Fla., April 2, 1872, William Stimpson coll. (Bache Expedition.)

Additional record.—Bend of Piedra Priata Reef, Barahona Harbor, Dominican Republic, July 23, 1933 (0–2 feet, station 167), J. C. Armstrong coll., 1 female (A.M.N.H.).

Description.—Trunk rather heavy, lateral processes separated by slightly more than their own diameter. Dorsal trunk tubercles not quite so tall as eye tubercle, pointed. Tubercles on lateral processes very short. In addition to the dorsal trunk tubercles on the three anterior trunk segments there is a small one over the base of the abdomen. Eye tubercle cylindrical at base, bluntly conical at apex. Eyes large, slightly protuberant, at middle of tubercle.

Proboscis pyriform, about three-fourths as long as trunk.

Abdomen about as long as last trunk segment, cylindrical.

Palpus 9-jointed. Second joint slightly curved, larger distally, longer than fourth.

Chelifore: Scape 1-jointed, about as long as neck. Chela globular.

Oviger heavy, 9-jointed. Third joint curved, without lateral tubercles, fourth joint about as long as third. Denticulate spines: 11:8:6:12. The last spine is not markedly denticulate and appears to be opposed to the terminal claw. Leg short, thick, with a prominent lateral line on the anterior side, extending out to the propodus. Femur and tibiae subequal. Tarsus very short, not much longer than wide. Propodus slender, curved, with a row of fine spines on the sole. Terminal claw stout, blunt, about three times as long as width at base.

Measurements.—As follows:

	Mm.		*Mm.*
Proboscis:		Third leg:	
Length	7.25	First coxae	1.0
Greater diameter	2.5	Second coxa	2.5
Trunk	10.0	Third coxa	1.2
Cephalic segment	4.5	Femur	6.5
Second lateral process, width	4.75	First tibia	7.0
Abdomen	1.9	Second tibia	6.5
		Tarsus	0.5
		Propodus	2.25
		Terminal claw	0.5

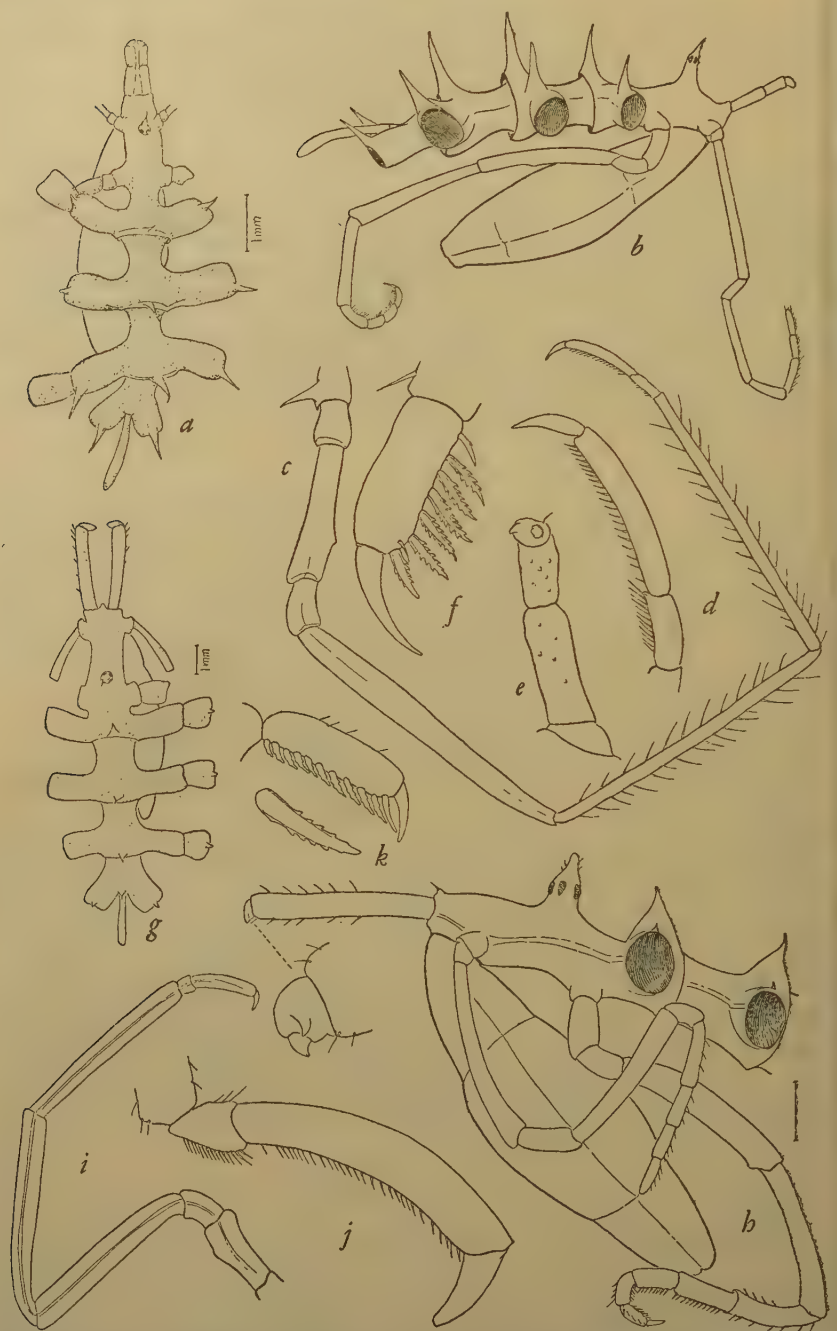

FIGURE 44.—*a–f*, *Ascorhynchus serratum*, new species: *a*, Dorsal view of holotype; *b*, lateral view; *c*, leg; *d*, tarsus and propodus; *e*, ventral view of chelifore; *f*, terminal joint of oviger; *g–k*, *A. colei* Hedgpeth: *g*, Dorsal view; *h*, lateral view of anterior segments; *i*, leg; *j*, tarsus and propodus; *k*, terminal joint of oviger.

Remarks.—The legs of one specimen have a vestment of very fine setae, those of the other specimens are glabrous. There is no significant variation in the size of the specimens. This species is closely related to *Ascorhynchus abyssi* Sars, 1891 (=*A. tridens* Meinert) from which it differs in the shape of the chelae and the shorter terminal claw. *A. abyssi* is a blind deep-water species, and does not have a fourth dorsal tubercle over the base of the abdomen. This is evidently a widely distributed Caribbean species, to judge from its occurrence in both Florida and southern Hispaniola.

ASCORHYNCHUS SERRATUM, new species

FIGURE 44, *a–f*

Holotype (female).—U. S. N. M. No. 81101, *Albatross* station 2359, Jan. 29, 1885, off Yucatán, lat. 20° 19′ 10″ N., long. 87° 03′ 30″ W., 231 fathoms.

Description.—Trunk slender, lateral processes separated by their own diameter. Dorsal trunk tubercles on first three trunk segments, tall, sharp; tubercles on lateral processes about two-thirds as tall. Eye tubercle near anterior end of neck, tall as dorsal tubercles, sharply pointed. Eyes about one-third from tip.

Proboscis pyriform, nearly as long as trunk, blunt at tip.

Abdomen as long as third trunk segment, slender, tip curved ventrally.

Palpus 8-jointed, longer than trunk. Second joint longest, fourth about two-thirds as long as second. Terminal joints slender, the last three setose ventrally.

Chelifore: Scape 2-jointed, the second slightly shorter than the first. Chela rudimentary.

Oviger 8-jointed, third slightly longer than fourth, with an angular projection near the distal third. Terminal joints with a row of long denticulate spines. Terminal claw curved, without denticulations, about half as long as terminal joint.

Leg slender, coxae without lateral projections or tubercles. Second coxa longer than first and third together. Femur slightly longer than first tibia, second tibia longer than femur, but shorter than first. Tibiae with spines slightly longer than the diameter of their joints, along their entire length. Tarsus little more than one-third as long as propodus, with a row of close-set ventral spines. Propodus slender, slightly curved, with about 20 spines on the sole. Terminal claw about as long as the tarsus.

Measurements.—As follows:

	Mm.	Third leg:	Mm.
Proboscis	4.9	First coxa	0.8
Diameter	1.5	Second coxa	2.5
Trunk	5.75	Third coxa	1.0
Cephalic segment	2.5	Femur	5.22
Second lateral process, width	3.0	First tibia	5.5
Abdomen	1.3	Second tibia	5.0
		Tarsus	0.5
		Propodus	1.3
		Terminal claw	0.5

Remarks.—This handsome species seems to be the only member of the group within the genus in which the propodus is intermediate which has a 2-jointed scape. It is further distinguished by the very tall pointed tubercles on the trunk and lateral processes, which give it a serrated appearance.

Genus EURYCYDE Schiödte, 1857

Chelifore 3-jointed, subchelate, scape slender. Palpi 9-jointed. Oviger 9- (or 10-)jointed, with terminal spine or spines. Propodus intermediate, without heel but with large terminal claw. The proboscis has a jointed petiole.

This genus is closely related to *Ascorhynchus* but differs from that genus in having a jointed proboscis. All the known species have long spines on the eye tubercle and abdomen. It is represented in eastern American waters by one species, hitherto known from west Africa. The widely distributed Boreal-Arctic *Eurycyde hispida* (Krøyer) has not been taken south of Baffin Land; it can easily be recognized by the lack of spines on the eye tubercle.

EURYCYDE RAPHIASTER Loman

FIGURE 45

Eurycyde raphiaster LOMAN, 1912, p. 13.—BOUVIER, 1917, pp. 33–35, pl. 4, figs. 2–7.

RECORDS OF COLLECTIONS

Lisbon Reef, Andros Island, Bahamas, May 13, 1912, from sponge, P. Bartsch coll., 1 male.

Tortugas, Fla., Bush Key, shallow water, male, July 16, 1926, from algae, C. R. Shoemaker coll. 1 (ov.).

At bend of Piedra Priata Reef, Barahona Harbor, Dominican Republic, July 8, 1933 (3 foot station 128), J. C. Armstrong coll., 1 male (A.M.N.H.).

Velero III, station A 15–39, Apr. 8, 1939, outside Bahia Honda, Colombia, 8–9 fathoms, corallines, 1 male, 1 juv.

This species was established for a single female found near Cape Verde. These specimens are evidently the male of that species. The lateral processes are slightly more widely separated, and there are six spines on the abdomen instead of seven. The spurlike proc-

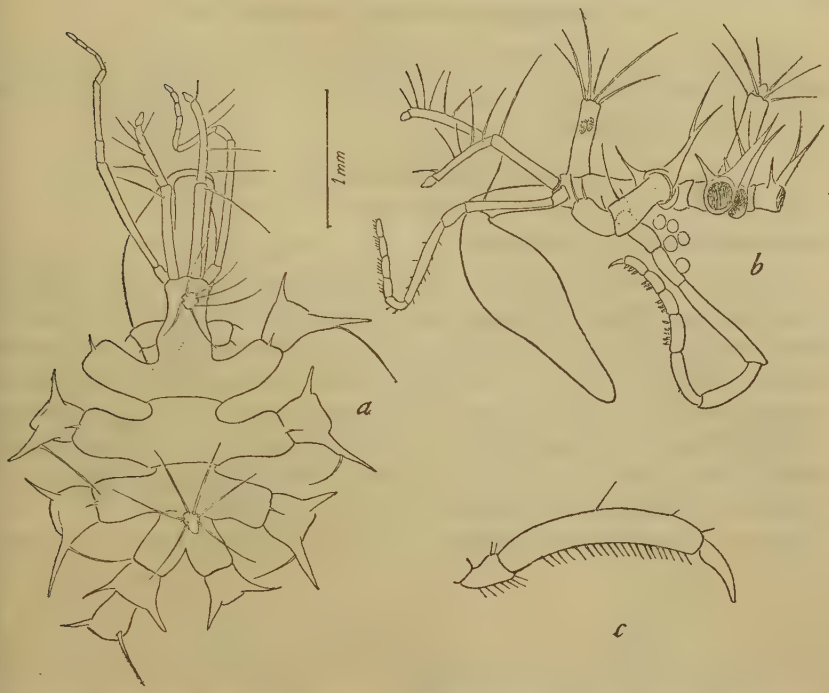

FIGURE 45.—*Eurycyde raphiaster* Loman: *a*, Dorsal view; *b*, lateral view (posterior end tilted away from field); *c*, tarsus and propodus.

esses on the first coxae have a long spine projecting dorsally, which is not present in the Cape Verde specimen. These differences are probably sexual.

Genus EPHYROGYMNA [25] Hedgpeth, 1943

Chelifore 3-jointed, subchelate. Palpi with four well-marked basal joints and an undetermined number of coalesced terminal segments. Oviger 10-jointed, with a large terminal claw. Propodus intermediate, without auxiliary claws. The chelifores, palpi, and proboscis originate within a flared prolongation of the cephalic segment.

EPHYROGYMNA CIRCULARIS Hedgpeth

FIGURE 46

Ephyrogymna circularis HEDGPETH, 1943b, pp. 51–52, pl. 9, figs. *a–g*.

A deep-water (525 fathoms) form, dredged off Martinique by the *Blake*. The anterior extension of the cephalic segment forms a rim around the origin of the proboscis, palpi, and chelifores; there is a notch ventrally beneath the proboscis, permitting the downward movement of that organ.

[25] The derivation of this name was omitted from the original description of this genus in the Proceedings of the New England Zoological Club (Hedgpeth, 1943b, p. 51). It should read as follows: *Ephyrogymna:* Εφύρα + γυμνός A naked sea nymph.

Genus HETEROFRAGILIA Hedgpeth, 1943

Chelifore 3-jointed, chelate. Palpi 9-jointed. Oviger 10-jointed, with terminal claw. Propodus intermediate, with a large terminal claw but no auxiliary claws.

HETEROFRAGILIA FIMBRIATA Hedgpeth

FIGURE 47

Heterofragilia fimbriata HEDGPETH, 1943b, pp. 53–54, pl. 10, figs. *a–i*.

Another curious pycnogonid from near Martinique (476 fathoms) whose nearest relative appears to be the East Indian *Pycnofragilia hamisetosa* (Loman).[26] In some respects it also resembles *Cilunculus* Loman (1908) but does not have the well-developed propodus characteristic of that genus. *Cilunculus* was originally reported from the East Indies and Japan, but it is also a Western Hemisphere genus, since Mello-Leitão's *Acanthammothella pennai* (1946) from Brazil is obviously a *Cilunculus*.

Both of these aberrant genera from Martinique are known from

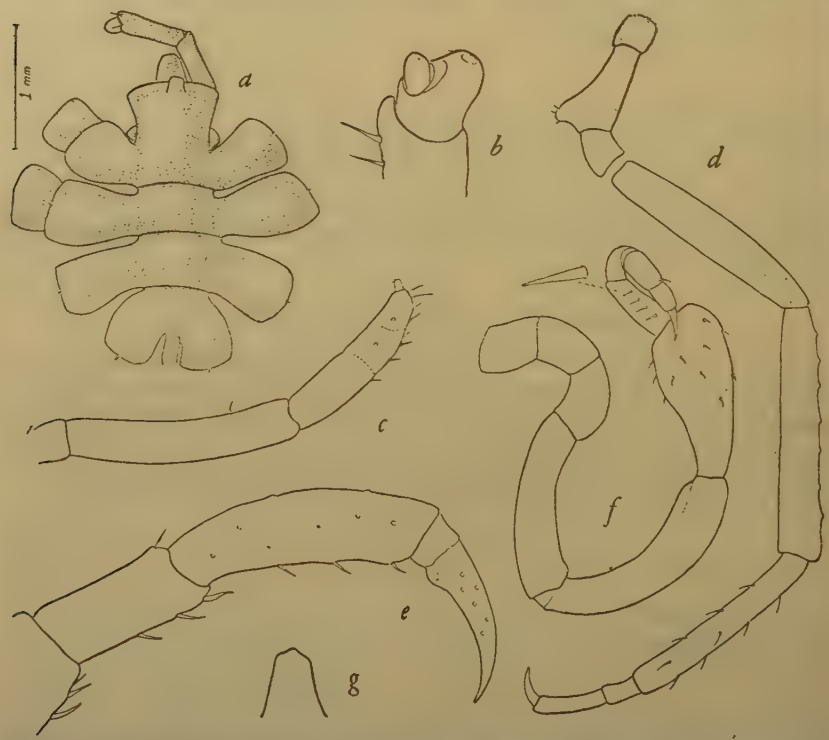

FIGURE 46.—*Ephyrogymna circularis* Hedgpeth: *a*, Dorsal view of holotype (proboscis foreshortened); *b*, ventral view of chela; *c*, terminal joints of palpus; *d*, leg; *e*, tarsal joints; *f*, oviger; *g*, anterior view of eye tubercle.

[26] Pro *Fragilia* Loman, 1908, preocc. *Fragilia* Deshayes 1845 (Mollusca). Hedgpeth, 1943b, p. 53.

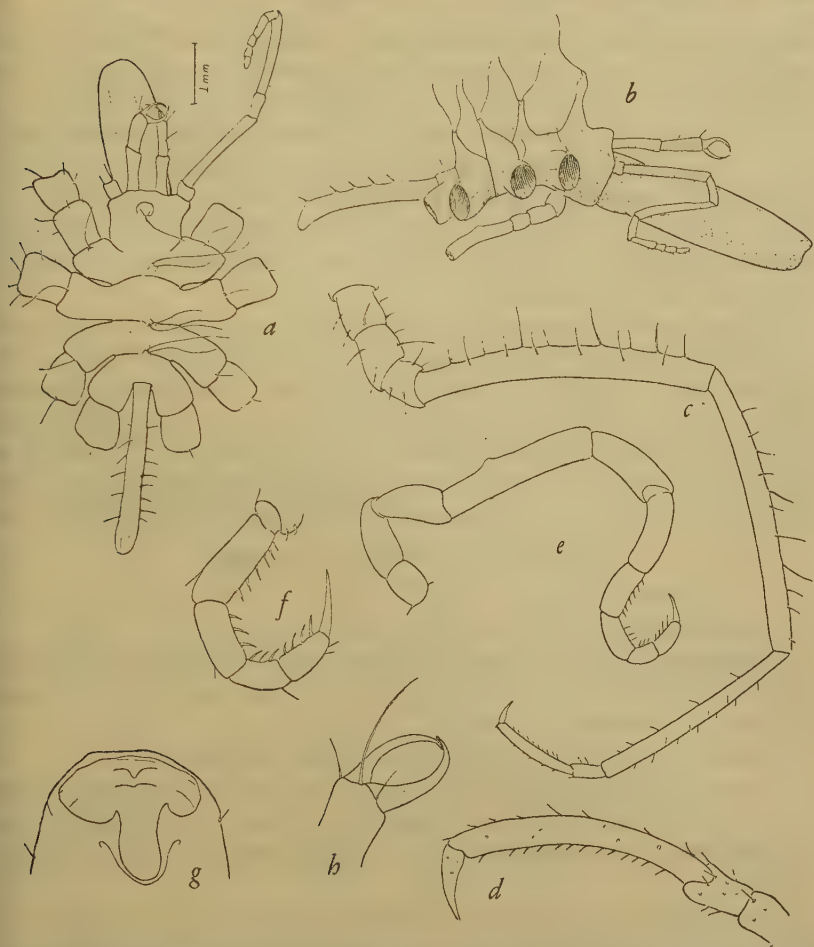

FIGURE 47.—*Heterofragilia fimbriata* Hedgpeth: *a*, Dorsal view of holotype; *b*, lateral view; *c*, leg; *d*, tarsus; *e*, oviger; *f*, terminal joints of oviger; *g*, ventral view of tip of proboscis; *h*, chela.

single specimens, and it is probable that future dredging in this area will turn up other curiosities.

CALYPSOPYCNON, new genus

Chelifore 2-jointed, scape trumpet-shaped, the chela chelate and hidden within the rim. Palpi 9-jointed. Oviger 9 (or 8?)-jointed, without a terminal claw. Propodus and terminal claw long, tapering. Body elongate, segmented. The structure of the chelifore resembles that of *Nymphopsis*, but the very long terminal claw of the leg, together with the short tarsus, resembles *Nymphonella* Ohshima (1927).

The pycnogonid described below was found among the collections of A. E. Verrill by Dr. Stanley C. Ball at the Peabody Museum.

Unfortunately it is without any label or clue to its origin, but it is possible that it may have been collected at Bermuda by Verrill on one of his excursions to that island. It is equally possible that it may have been taken from an *Albatross* dredge collection, perhaps in the Philippines. A pencil sketch, possibly of this same specimen, was found among some notes on Philippine species prepared by Dr. Leon J. Cole more than 30 years ago. It is, however, without any data, and was not drawn by Dr. Cole, and he cannot remember how it came to be included among his notes.

The specimen is mounted in balsam, which has dried into a beautiful pattern of air bubbles around the legs and trunk and has flattened the specimen to less than 0.25 mm. in thickness; in fact the specimen looks more like a design for surrealistic wall paper than a pycnogonid. This makes it difficult to see some of the finer details. It is such an interesting creature, however, that I cannot resist publishing a description of it in spite of the lack of information concerning it.

CALYPSOPYCNON GEORGIAE,[27] new species

FIGURE 48

Holotype (female).—Y.P.M. No. 7308.

Description.—Trunk completely segmented, lateral processes separated by about their own width. Eye tubercle low, rounded, with four large well-developed eyes.

Proboscis half as long as trunk, elliptical in outline.

Abdomen not quite so long as proboscis, slender. There appears to be a protuding structure of some kind about a third of the way from the end. This may be a fold caused by the flattening of the specimen.

Palpus 9-jointed, the second longest, fourth half as long as the second. Terminal joint as long as preceeding two joints together. No spines or setae.

Chelifore 2-jointed, scape expanded distally, chela submerged in the cup. Chelae small, chelate, with a large terminal spine on each blunt finger.

Oviger: There seem to be three basal joints on one oviger, and two on the other, but the details are obscure. Probably there are three basal joints on each oviger. The four terminal joints bear a single row of spines in the following formula: 9:12:12:12. Terminal joint tapering toward tip.

Leg: Second coxa longest, third slightly shorter, first shortest. Femur slightly longer than the coxae together. Tibiae subequal, slightly longer than the femur. Tarsus about half again as long as wide, propodus nearly as long as femur, terminal claw as long as

[27] Καλυψώ, one of the 3,000 daughters of Tethys and Oceanus (or perhaps Atlas), the mistress of the Island of Ogygia, whose charms fascinated that man about the Mediterranean, Ulysses, for seven years, πυκνόν compact or thickset. This species is dedicated to a friend who shares Calypso's charms.

propodus, tapering to a point. There is a small rounded dorsal tubercle on the lateral processes and first two coxae of all the legs. Genital pores present on all second coxae.

Measurements.—As follows:

	Mm.
Proboscis	2. 3
Trunk	4. 8
Abdomen	2. 0
Scape	1. 25

Third leg:	*Mm.*
First coxa	0. 7
Second coxa	1. 25
Third coxa	1. 0
Femur	2. 5
First tibia	3. 0
Second tibia	3. 0
Tarsus	0. 5
Propodus	2. 0
Terminal claw	1. 8

Remarks.—The specimen is an almost mature female; the trunk and legs, well out into the propodus, are densely packed with small eggs, about 0.04 mm. in diameter.

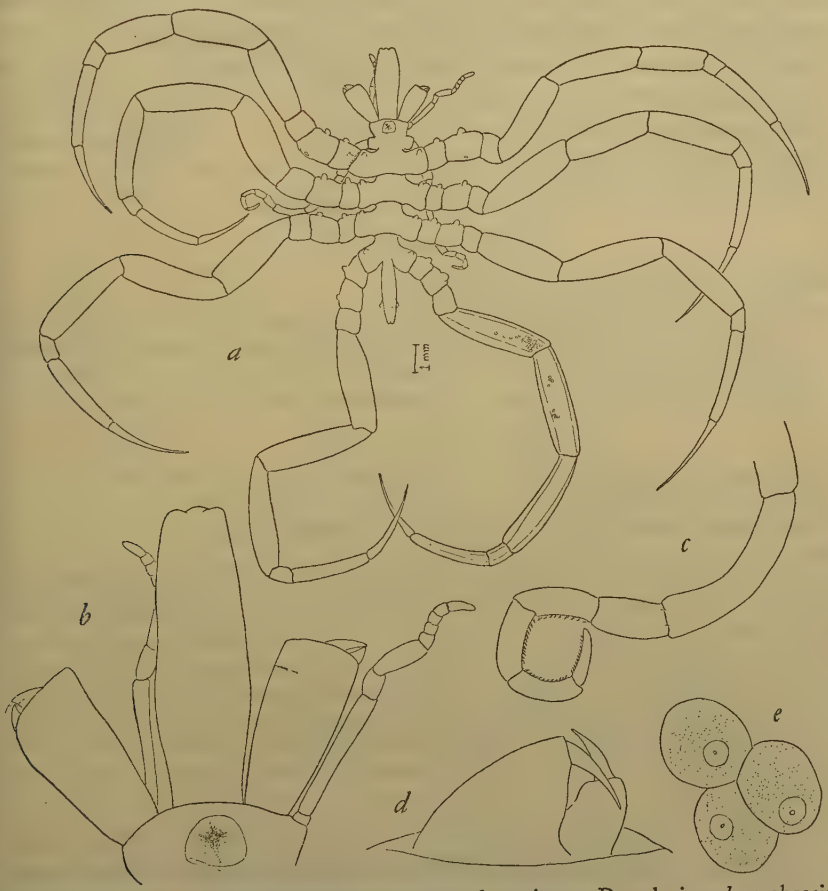

FIGURE 48.—*Calypsopycnon georgiae*, new genus and species: *a*, Dorsal view; *b*, proboscis, chelifores, and palpi; *c*, oviger; *d*, chela; *e*, eggs.

Family TANYSTYLIDAE Schimkewitsch, 1913

Chelifores 1- or 2-jointed, achelate, very small. Palpi 4- to 6-jointed. Ovigers 10-jointed, in both sexes. Legs short, with well-developed propodus. A group of small compact forms, represented by the genus *Tanystylum* in the western Atlantic. In *Clotenia*, a genus represented on the African coast, the palpi are 4-jointed. This genus may be a taxonomic fiction.

Genus TANYSTYLUM Miers, 1879

Chelifores 1- or 2-jointed. Palpi 5- or 6-jointed. Ovigers 10-jointed. Trunk compact, circular.

It is probably an accident of collecting that no species of *Tanystylum* are represented in the collections from the Caribbean proper. *Tanystylum orbiculare* is a common littoral species from Woods Hole to Virginia, South Carolina, and Florida and has been collected by Marcus in the vicinity of Rio de Janeiro, Brazil. Another curious anomaly is the collection of *Tanystylum calicirostre* at Bermuda. The species was previously known from the Gulf of Panama, on the Pacific side of the isthmus.

1. Proboscis rounded or slightly tapered at tip..... **orbiculare** (p. 266)
   Proboscis conspicuously tapered or styliform..... **calicirostre** (p. 268)

TANYSTYLUM ORBICULARE Wilson

FIGURES 8; 49, *a*

?*Pasithoe umbonata* GOULD, 1844, pp. 92–93.

Tanystylum orbiculare WILSON, 1878b, pp. 5–7, pl. 2, fig. 2, *a–f*; 1880, pp. 471–473, pl. 3, fig. 11.—MORGAN, 1891, pp. 37–49 (embryology).—SUMNER, OSBURN, and COLE, 1913, pp. 141–142, 677, chart 120.—FISH, 1925, p. 161.—MARCUS, 1940b, pp. 105–108, fig. 15, *a–h*.—HEDGPETH, 1943b, pp. 54–55.

RECORDS OF COLLECTIONS

Fish Hawk station 8341, Oct. 22, 1915, Chesapeake Bay, lat. 37°22′12″ N., long. 76°10′25″ W., 9.5 fathoms, 1 female.

Fish Hawk station 8506, Apr. 22, 1916, Chesapeake Bay, lat. 37°16′50″ N., long. 76°14′27″ W., 5.5 fathoms, 1 male.

Fish Hawk, July 15, 1916, on Lynnhaven Trolley bridge, Va., 2 males, 2 females.

Virginia Beach, Va., from mast washed ashore, Oct. 5, 1943, W. H. Ball, coll. 1 male, 2 females, 3 juv.

One mile inside May River, S. C., Jan. 17, 1891, 1 specimen.

Charleston Harbor, S. C., Apr. 11, 1935, 4 specimens.

Port Aransas, Tex., Mar. 25, 1945, from sargassum cast ashore, J. W. Hedgpeth coll., numerous specimens, but no ovigerous males.

(Also numerous specimens from Marthas Vineyard, Newport, R. I., and Woods Hole).

A common but easily overlooked littoral species, not found north of Cape Cod. Specimens from Rio de Janeiro are heavier than typical material from southern New England, and the segmentation of the

third and fourth joints of the palpus is not evident except as a constriction in the Brazilian variety. In the sargassum specimens from Texas the segmentation between these joints is more plainly marked but does not seem to be a functional articulation. These specimens are all quite small, being not more than 4 mm. in extent, and usually about 3 mm. (fig. 8).

Both Norman (1908) and Bouvier (1923) considered *Clotenia conirostris* Dohrn (1881) synonymous with *T. orbiculare*. Except for the 4-jointed palpi, which Marcus considers a character of generic importance, *C. conirostris* is very similar to *T. orbiculare*, and the occurrence of the Brazilian variety suggests that we have here a somewhat complex species and that the genus *Clotenia* is untenable.

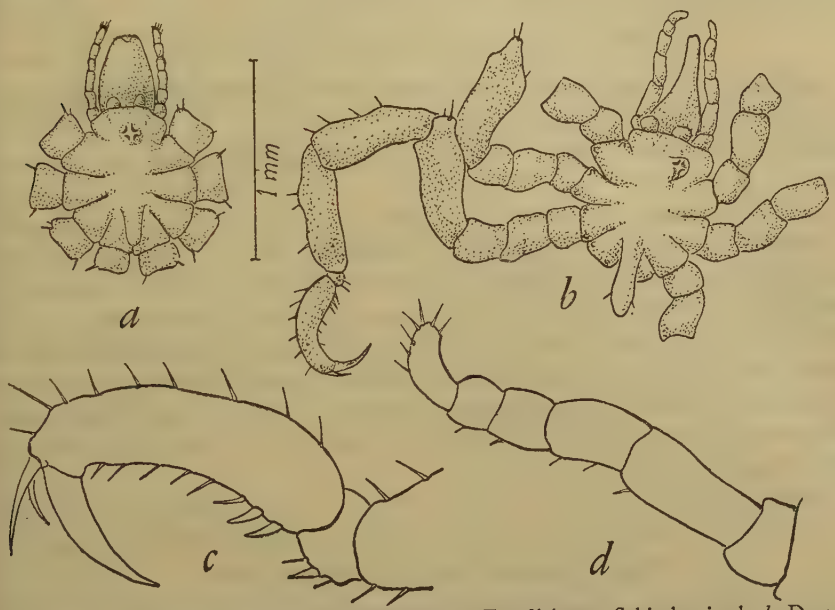

FIGURE 49.—*a*, *Tanystylum orbiculare* Wilson; *b–d*, *T. calicirostre* Schimkewitsch; *b*, Dorsal view; *c*, tarsus and propodus; *d*, palpus.

Perhaps the European and Brazilian forms are geographical varieties of *T. orbiculare*. In the Brazilian form, however, the segmentation of the third and fourth joints of the palpi is indistinct but not completely obliterated, whereas in the European *C. conirostris* the palpi have lost yet another joint. None of the published figures indicate this character very clearly, and without comparative material from Europe it seems best to consider *C. conirostris* at least specifically distinct from *T. orbiculare*. Unfortunately none of the Texas material seems to be sexually mature, but it is not improbable that mature specimens will show transitional relationships between the North and South American varieties.

Distribution.—Long Island to Brazil, Tex. Represented in the Woods Hole Oceanographic Institution fouling collections from eastern Florida and the Bahamas.

TANYSTYLUM CALICIROSTRE Schimkewitsch

FIGURE 49, *b–d*

Tanystylum calicirostre SCHIMKEWITSCH, 1889, pp. 331–333, figs. 5–7.

Record of collection.—Bermuda, 1901, A. E. Verrill coll., 1 female (Y. P. M. No. 7305).

This specimen agrees with the original description except that the spines on the legs and palpi are smaller and less numerous, and the dorsal trunk tubercles are apparently smaller.

Family COLOSSENDEIDAE Hoek, 1881

A family of large, deep-water forms with very long legs, 9- or 10-jointed palpi, and a large proboscis. Ovigers are 10-joined, with a terminal claw and spines on the terminal segments, present in both sexes.

It is represented in western Atlantic waters by five or six species of *Colossendeis*, and the 10-legged *Pentacolossendeis*, which resembles *Colossendeis* in all other details except its extra pair of legs. Practically nothing is known of the habits of these deep-water pycnogonids, and their early development is still a mystery. Egg-bearing males have never been found, although occasional specimens with adherent bodies or capsules attached to the legs, which might be egg capsules, have been observed (*cf.* Hoek, 1881, pp. 65, 143; and Cole, 1909, pp. 190–191, pl. 3, figs. 11–12).[28]

1. Four pairs of legs ..... **Colossendeis** (p. 268)
   Five pairs of legs ..... **Pentacolossendeis** (p. 275)

Genus COLOSSENDEIS Jarzynsky, 1870

Chelifores lacking in adults (but occasionally persistent in nearly mature specimens). Palpi 9-jointed. Ovigers 10-jointed, with terminal claw and spines on terminal segments. Tarsus and propodus tapering. Key to western Atlantic species:

1. Terminal claw very short (shorter than propodus); antepenult joint of palpus as long or longer than succeeding joint 2
   Terminal claw nearly as long as propodus; antepenult joint of palpus very short ..... **angusta** (p. 269)
2. Proboscis thick, spindle-shaped or clavate, or curved downward, not twice as long as trunk 3
   Proboscis very slender, twice as long as trunk, curved slightly upward at tip ..... **macerrima** (p. 273)

[28] Ovigerous males of *Decolopoda* are also unknown. This cannot be considered a character for uniting the Decolopodidae and Colossendeidae, however. No egg-bearing males of *Ascorhynchus armatus* have been found, and it is possible that its life history may be similar to that of *Colossendeis*.

3. Proboscis swollen at tip, which is directed downward; *or*, distal third curved ventrally 4
   Proboscis spindle-shaped, straight 5
4. Proboscis wider at tip than base; sole of propodus and tarsus with a row of spines ..... **clavata** (p. 273)
   Proboscis not wider at tip, but curved downward; without spines on tarsus and propodus ..... **michaelsarsi** (p. 274)
5. Very large, extent about 20 inches ..... **colossea** (p. 271)
   Small form of the above, extent 6–10 inches ..... **minuta** (p. 272)

COLOSSENDEIS ANGUSTA Sars

FIGURE 50, *a*

Colossendeis angusta SARS, 1877, pp. 268–269.—WILSON, 1881, pp. 243–244, pl. 3, figs. 8, 13.
Colossendeis gracilis HOEK, 1881, pp. 69–70, pl. 9, figs. 6–8; pl. 10, figs. 6, 7.
Colossendeis angusta VERRILL, 1885, p. 560.
Colossendeis gracilis S. I. SMITH, *in* Verrill, 1885, p. 560.
Colossendeis angusta SARS, 1891, pp. 140–143, pl. 15, fig. 2, *a–f*.—BOUVIER, 1917, pp. 8–9 (synonymy).—STEPHENSEN, 1933, pp. 28–30, figs. 6 (map), 7.—BOUVIER, 1937, pp. 25–26.—CALMAN, 1938, pp. 148–149.
Colossendeis gracilis MARCUS, 1940b, p. 110.
Colossendeis angusta NEEDLER, 1943, p. 5, fig. 2, *a–d*.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2041	July 30, 1883	39 22 50	68 25 00	1,608	2
2042	July 30, 1883	39 33 00	68 26 45	1,555	1
2043	July 30, 1883	39 49 00	68 25 30	1,467	1
2050	Aug. 1, 1883	39 42 50	69 21 20	1,050	1
2057	Aug. 30, 1883	42 01 00	68 00 30	86	1
2074	Sept. 3, 1883	41 43 00	65 21 50	1,309	1
2076	Sept. 4, 1883	41 13 00	66 00 50	906	1
2093	Sept. 21, 1883	39 42 50	71 01 20	1,000	1
2102	Nov. 5, 1883	38 44 00	72 38 00	1,209	2
2103	Nov. 5, 1883	38 47 20	72 37 00	1,091	1
2105	Nov. 6, 1883	37 50 00	73 03 50	1,395	2
2106	Nov. 6, 1883	37 41 20	73 03 20	1,497	1
2111	Nov. 11, 1883	35 09 50	74 57 40	938	1
2115	Nov. 11, 1883	35 49 30	74 34 45	843	1
2173	July 21, 1884	37 57 00	72 34 00	1,600	2
2193	Aug. 5, 1884	39 44 30	70 10 30	1,122	2
2195	Aug. 5, 1884	39 44 00	70 03 00	1,058	1
2196	Aug. 6, 1884	39 35 00	69 44 00	1,230	5
2205	Aug. 20, 1884	39 35 00	71 18 45	1,073	2
2209	Aug. 21, 1884	39 34 45	71 31 30	1,080	2
2210	Aug. 21, 1884	39 37 45	71 18 45	991	2
2211	Aug. 21, 1884	39 35 00	71 18 00	1,064	2
2217	Aug. 23, 1884	39 47 20	69 34 15	924	1
2221	Sept. 6, 1884	39 05 30	70 44 30	1,525	1
2222	Sept. 6, 1884	39 03 15	70 50 45	1,537	6
2231	Sept. 12, 1884	38 29 00	73 09 00	965	1
2232	Sept. 12, 1884	38 37 30	73 11 00	243	1
2430	June 23, 1885	42 58 30	50 50 00	179	1
2469	July 4, 1885	44 58 37	56 20 45	201	1
2470	July 4, 1885	44 47 00	56 33 45	224	2

ALBATROSS RECORDS—continued

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2471	July 4, 1885	44 34 00	56 41 45	218	5
2534	July 15, 1885	40 01 00	67 29 15	1,234	2
2535	July 15, 1885	40 03 30	67 27 15	1,149	1
2550	Aug. 9, 1885	39 44 30	70 30 45	1,081	6
2562	Aug. 11, 1885	39 15 30	71 25 00	1,434	2
2563	Aug. 11, 1885	39 18 30	71 23 30	1,422	1
2564	Aug. 11, 1885	39 22 00	71 23 30	1,390	5
2571	Sept. 1, 1885	40 09 30	67 09 00	1,356	6
2572	Sept. 2, 1885	40 29 00	66 04 00	1,769	2
2573	Sept. 2, 1885	40 34 18	66 09 00	1,742	4
2575	Sept. 3, 1885	41 07 00	65 26 30	1,710	1
2682	July 16, 1886	39 38 00	70 22 00	1,004	4
2684	July 17, 1886	39 35 00	70 54 00	1,106	2
2706	Aug. 27, 1886	41 28 30	65 35 30	1,188	2
2710	Aug. 28, 1886	40 06 00	68 01 30	984	1
2711	Sept. 16, 1886	38 59 00	70 07 00	1,544	1
2725	Oct. 24, 1886	36 34 00	73 48 00	1,374	2
2731	Oct. 25, 1886	36 45 00	74 28 00	781	1
2732	Oct. 26, 1886	37 27 00	73 33 00	1,152	3
2748	Sept. 19, 1887	39 31 00	71 14 30	1,163	1

This is the commonest species of the genus in western Atlantic waters, usually at depths from 900 to 1,700 fathoms. There are several records from around 200 fathoms, and one (*Albatross* station 2057) from 86 fathoms. This specimen is about one-third as large as the usual size. The predominant types of bottom from which this species was taken by the *Albatross* are globigerina ooze and green mud.

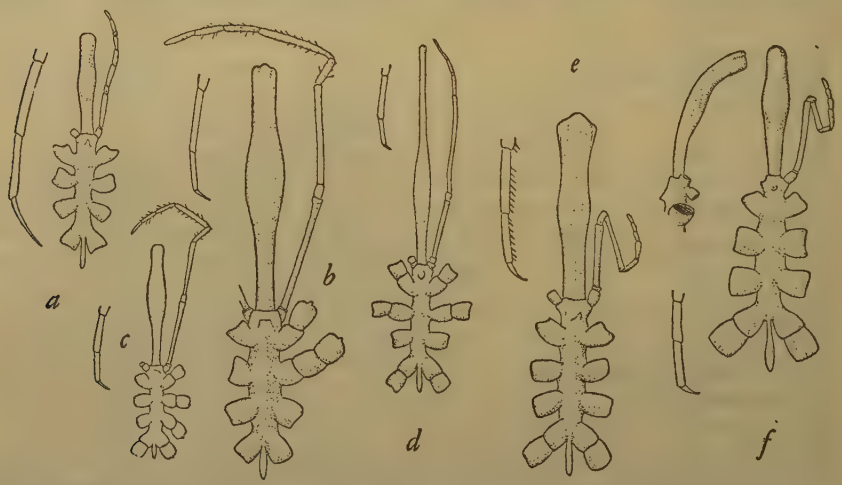

FIGURE 50.—*a*, *Colossendeis angusta* Sars; *b*, *C. colossea* Wilson; *c*, *C. minuta* Hoek; *d*, *C. macerrima* Wilson; *e*, *C. clavata* Meinert; *f*, *C. michaelsarsi* Olsen. (*a*, × 2; all others natural size.)

Distribution.—A eurybathic species of the Arctic and deep Polar Basin (Stephensen); deep North Atlantic. According to the suggested synonymies of Bouvier and Calman, it is a world-wide deep-sea species of the Atlantic, Pacific, and Indian Ocean basins. Stephensen remarks that it is not found "from waters east of America abt. 40° to 66° N." Several of the above records are near 44° and similar intensive dredging would probably reveal its presence farther north along the edge of the continent.

COLOSSENDEIS COLOSSEA Wilson

FIGURE 50, *b*

Colossendeis colossea WILSON, 1881, pp. 244–246, pl. 1, fig. 1; pl. 3, figs. 5–7.—VERRILL, 1885, p. 560, fig. 169.—BOUVIER, 1917, pp. 13–16, pl. 1, fig. 2; pl. 2, fig. 1 (synonymy, color plates).—BOUVIER, 1937, pp. 31–32.—HEDGPETH, 1943b, pp. 55–56.—NEEDLER, 1943, p. 4, fig. 1, *a-c*.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2050	Aug. 1, 1883	39 42 50	69 21 20	1,050	1
2051	do	39 41 00	69 20 20	1,106	5
2052	do	39 40 05	69 21 25	1,098	2
2072	Sept. 2, 1883	41 53 00	65 35 00	858	1
2077	Sept. 4, 1883	41 09 40	66 02 20	1,255	4
2078	do	41 11 30	66 12 20	499	2
2094	Sept. 21, 1883	39 44 30	71 04 00	1,022	5
2103	Nov. 5, 1883	38 47 20	72 37 00	1,091	1
2110	Nov. 9, 1883	35 12 10	74 57 15	516	3
2111	Nov. 11, 1883	35 09 50	74 57 40	938	3+
2115	do	35 49 30	74 34 45	843	2+
2192	Aug. 5, 1884	39 46 30	70 14 45	1,060	2
2193	do	39 44 30	70 10 30	1,122	4
2195	do	39 44 00	70 03 00	1,058	2
2196	Aug. 6, 1884	39 35 00	69 44 00	1,230	18
2205	Aug. 20, 1884	39 35 00	71 18 45	1,073	4
2209	Aug. 21, 1884	39 34 45	71 31 30	1,080	7
2210	do	39 37 45	71 18 45	991	6
2217	Aug. 23, 1884	39 47 20	69 34 15	924	2
2220	do	39 43 30	69 23 00	1,054	2
2230	Sept. 12, 1884	38 27 00	73 02 00	1,168	1
2231	do	38 29 00	73 09 00	965	1
2530	July 14, 1885	40 53 30	66 24 00	956	7
2532	do	40 34 30	66 48 00	705	2
2533	July 15, 1885	40 16 30	67 26 15	828	16+
2550	Aug. 9, 1985	39 44 30	70 30 45	1,081	7
2681	July 16, 1886	39 43 00	70 29 00	990	3+
2683	July 17, 1886	39 33 00	70 50 00	887	1
2684	do	39 35 00	70 54 00	1,106	1
2710	Aug. 28, 1886	40 06 00	68 01 30	984	12
2725	Oct. 24, 1886	36 34 00	73 48 00	1,374	1
2727	do	36 35 00	74 03 30	1,239	3
2728	Oct. 25, 1886	36 30 00	74 33 00	859	4
2731	do	36 45 00	74 28 00	781	1
2734	Oct. 26, 1886	37 23 00	73 53 00	841	1
2739	Sept. 17, 1887	37 34 30	37 58 00	811	1

ATLANTIS RECORDS (specimens in M. C. Z. identified by F. A. Chace)

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
(1)	Aug. 11, 1937	39 28	71 58	640	2
(2)	Aug. 3, 1938	37 43	73 40	1,105	1
3990	Aug. 14, 1940	38 05	73 40	990	1

Colossendeis colossea is the largest pycnogonid in the North Atlantic; its bathymetric range off the eastern United States is roughly 500 to 1,400 fathoms. It is a bright orange-scarlet in life. Though not so widely distributed as *C. angusta*, it is occasionally taken in greater numbers at individual stations.

Distribution.—Possibly a world-wide species of the deeper ocean basins.

COLOSSENDEIS MINUTA Hoek

FIGURE 50, *c*

Colossendeis minuta HOEK, 1881, pp. 73–74, pl. 10, figs. 12–14.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2093	Sept. 21, 1883	39 42 50	71 01 20	1,000	1
2728	Oct. 25, 1886	36 30 00	74 33 00	859	1
2734	Oct. 26, 1886	37 23 00	73. 53 00	841	1
2735	do	37 23 00	74 02 00	811	1—

ATLANTIS RECORD (M. C. Z. No. 12219)

(3)	July 26, 1939	40 05	68 05	1,105–1,135	1

Except for its smaller size, this species is very close to *Colossendeis colossea* and may be a dwarf variety of that species. Hoek's specimen was taken by the *Challenger* at station 50 (lat. 42°08′ N, long. 63°39′ W; 1,250 fathoms, south of Halifax, Nova Scotia). The only intermediate form in the collection is a specimen from *Albatross* station 2725, in which the trunk and proboscis are as large as full-grown *C. colossea*, but the legs are about two-thirds as long. This appears to be an abnormal *colossea* and has been referred to that species. The specimens identified as *C. minutea* are perfectly proportioned, and at least one (*Albatross station* 2735) appears to be mature. This specimen is about 25 cm. in extent, which is about half the size of the average *C. colossea*.

COLOSSENDEIS MACERRIMA Wilson

FIGURE 50, *d*

Colossendeis macerrima WILSON, 1881, pp. 246–247, pl. 1, fig. 2; pl. 4, figs. 9–12; pl. 5, fig. 32.——VERRILL, 1885, p. 560, fig. 170.—BOUVIER, 1917, p. 10, pl. 1, fig. 1; pl. 3, figs. 1, 2 (synonymy).—CALMAN, 1923, pp. 267–268.—BOUVIER, 1937, pp. 30–31.

Colossendeis gigas-leptorhynchus BOUVIER, 1937, pp. 32–33.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2072	Sept. 2, 1883	41 53 00	65 35 00	858	2
2083	Sept. 5, 1883	40 26 40	67 05 15	959	1
2093	Sept. 21, 1883	39 42 50	71 01 20	1,000	1
2115	Nov. 11, 1883	35 49 30	74 34 45	843	3
2205	Aug. 20, 1884	39 35 00	71 18 45	1,073	1
2530	July 14, 1885	40 53 30	66 24 00	956	3
2533	July 15, 1885	40 16 30	67 26 15	828	1
2589	Sept. 21, 1885	38 55 00	72 50 30	231	1
2678	May 6, 1886	32 40 00	76 40 30	731	2
2725	Oct. 25, 1886	36 30 00	74 33 00	859	1
2734	Oct. 26, 1886	37 23 00	73 53 00	841	1

OTHER RECORDS

Fish Hawk 1092	Aug. 11, 1882	39 53	69 47	317	1
Wm. Beebe 115 (net 157)	June 8, 1929	Bermuda circle [center, 32°12′ N., 64°36′ W.]		1,100 (deep tow)	1 juv.
Atlantis 24	Apr. 14, 1937	"Gulf, no label"		1,000 meters	1 juv.

This species is easily identified by its long proboscis.

Distribution.—Possibly the Atlantic, Pacific, and Indian Ocean basins. Off the eastern United States it has been taken in depths of 200 to 1,000 fathoms.

COLOSSENDEIS CLAVATA Meinert

FIGURE 50, *e*

Colossendeis clavata MEINERT, 1899, pp. 57–58, pl. 5, figs. 19, 20.—BOUVIER, 1917, pp. 9–10; 1937, p. 26, fig. 1.

A well-defined species of the North Atlantic basin. In the western Atlantic it occurs at depths around 1,000 fathoms.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of Specimens
		° ′ ″	° ′ ″	*Fathoms*	
2034	July 17, 1883	39 27 10	69 56 20	1,346	1
2051	Aug. 1, 1883	39 41 00	69 20 20	1,106	1
2072	Sept. 2, 1883	41 53 00	65 35 00	858	4
2075	Sept. 3, 1883	41 40 30	65 35 00	855	1
2076	Sept. 4, 1883	41 13 00	66 00 50	906	1
2196	Aug. 6, 1884	39 35 00	69 44 00	1,230	2
2205	Aug. 20, 1884	39 35 00	71 18 45	1,073	7
2207	do	39 35 33	71 31 45	1,061	2
2209	Aug. 21, 1884	39 34 45	71 31 30	1,080	2
2210	do	39 37 45	71 18 45	991	3

COLOSSENDEIS MICHAELSARSI Olsen

FIGURE 50, *f*

Colossendeis michaelsarsii OLSEN, 1913, pp. 4–5, figs. 1–4, pl. 1, fig. *A*.
Colossendeis arcuata BOUVIER, 1937, pp. 26–30, figs. 2–8.

Record of collection.—*Albatross* station 2072, Sept. 2, 1883, lat. 41°53′00″ N., long. 63°35′00″ W., 858 fathoms, 1 specimen.

Olsen's description of this species is based on a single specimen dredged by the *Michael Sars* at station 41, lat. 28°08′ N., long. 13°35′ W.; 1,365 meters (off the coast of Africa). Bouvier, apparently unaware of Olsen's paper, ascribes this species to Alphonse Milne-Edwards and considers that it dates from 1885 on the basis of the publication of a drawing in a semipopular book on marine life (H. Filhol, "La Vie au Fond des Mers," Paris, 1885). This illustration (fig. 48, p. 151) and Bouvier's drawings suggest Olsen's species. The legend in Filhol's book reads: "Colossendeis arcuatus (A. M.—Edw.) pris à 1,500 metres de profondeur, Expedition du Talisman." Bouvier gives the station as No. 33, May 17, 1883, lat. 32°34′ N., long. 9°48′ W. (Paris?), 869 fathoms. This seems to be, according to Sanderson Smith's (1889) lists, station 34, 32°31′ N., 9°48′ W., 1,350 meters. This general locality is 5° or 6° north of the *Michael Sars* station.

Had Bouvier seen Olsen's paper, it is probable that he would have persisted in trying to establish Milne-Edwards priority on the basis of the published figure, but it does not seem to me that this is adequate, especially since the species was not specifically designated as new and reasonable procedure demands that such manuscript names be rejected.

While there is some difference in the shape of the proboscis in Bouvier's drawing, it is not great enough to separate it from Olsen's species on taxonomic grounds.

Colossendeis michaelsarsi appears to be a North Atlantic basin form.

Genus PENTACOLOSSENDEIS Hedgpeth, 1943

This genus resembles *Colossendeis* in all particulars except that it has five pairs of legs. The completely segmented body of the genotype is probably a specific character, as there are several species of *Colossendeis* in which the body is completely segmented. Some of these segmented forms have been referred to *Rhopalorhynchus*, which is an uneasy genus.

PENTACOLOSSENDEIS RETICULATA Hedgpeth

FIGURE 51, *a-e*

Pentacolossendeis reticulata HEDGPETH, 1943b, pp. 56–57 (diagnosis)

RECORDS OF COLLECTIONS

Fish Hawk station 7279, Feb. 14, 1902, lat. 24°21′55″ N., long. 81°58′25″ W., Gulf Stream, off Key West, 98 fathoms, 3 females (holotype and 2 paratypes: U.S.N.M. No. 81102).

Bache station (3), Apr. 13, 1872, off San Key, Fla., 104 fathoms, 1 female (paratype: M.C.Z. No. 12235).

State University of Iowa Bahamas Expedition station 64, June 29, 1893, Pourtalès Plateau, near American Shoal Light, 110 fathoms, 1 female.

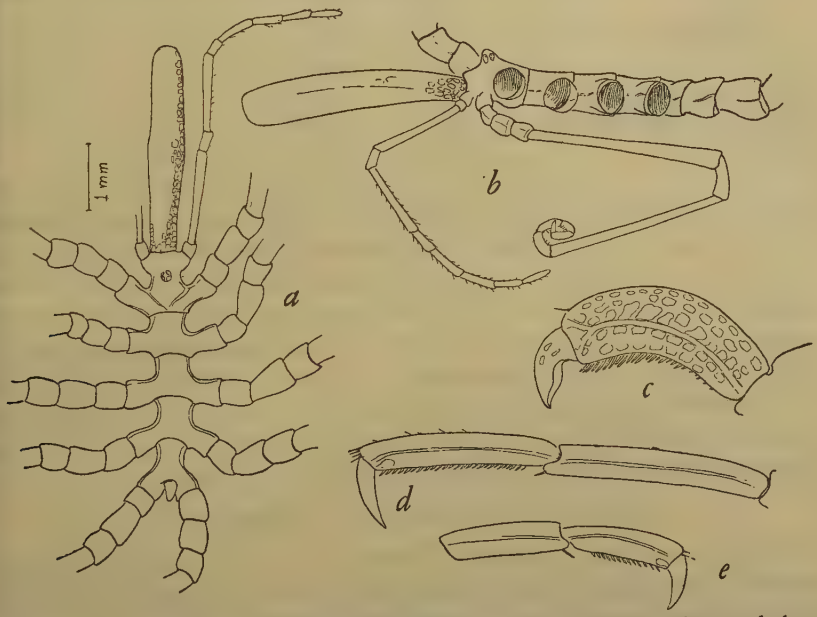

FIGURE 51.—*Pentacolossendeis reticulata* Hedgpeth: *a*, Dorsal view of holotype; *b*, lateral view; *c*, terminal joint of oviger; *d*, tarsus and propodus; *e*, tarsus and propodus of second leg (to same scale as *d*).

Description.—Trunk elongated, cylindrical, completely segmented, with annular swellings. Lateral processes separated by about their own diameter. Eye tubercle slightly higher than wide, rounded. Eyes large, lightly pigmented. Integument reticulated on proboscis,

less conspicuously so on trunk and legs. The body integument is also covered with minute tubercles.

Proboscis about as long as trunk, slightly curved, largest at tip.

Abdomen small, bluntly conical.

Palpus slender, longer than proboscis. Second joint longest, fourth slightly shorter. Sixth and seventh joints subequal, longer than fifth, eight and ninth subequal, longer than fifth. Joints 4 to 9 with small setae.

Oviger: Basal joints small, subequal. Fourth joint longest, straight, largest distally, sixth joint not quite so long as fourth. Terminal joints diminishing in size, with several rows of spines, as in *Colossendeis*. Terminal claw scoop-shaped.

Leg: Long, slender, with scattered fine setae and a prominent chitinous line extending out to the propodus. Tarsus and propodus subequal, propodus with a row of small spines on the sole. Terminal claw about three times as long as within at base, blunt.

Measurements.—As follows:

	Mm.		*Mm.*
Proboscis:		Fourth leg:	
Length	3. 1	Coxae	1. 5
Diameter	0. 6	Femur	7. 75
Trunk	3. 5	First tibia	8. 5
Cephalic segment	1. 0	Second tibia	6. 5
Third trunk segment, width	1. 5	Tarsus	1. 5
Abdomen	0. 25	Propodus	1. 25
		Terminal claw	0. 5

Remarks.—The second pair of legs of the holotype and the specimen from University of Iowa Station 64 are shorter than the other legs and of slightly less diameter. This difference is most marked in the tarsal joints (fig. 51, *d*, *e*). Genital pores seem to be present on all five pairs of second coxae of the holotype and on the last four pairs of the paratypes. They do not seem to be on the second pair of legs in the Pourtalès specimen but may not yet have developed. Such pores as could be made out seem to be too large for the male, and the sexual determination must be considered tentative.

Family PYCNOGONIDAE Wilson, 1878

Chelifores and palpi absent Oviger 6- to 9- jointed, with a large terminal claw which is considered by some to be another segment, present only in the male. The propodus is well developed, but without a heel or heavy basal spines. Members of this family are chacterized by short, knobby legs, which gives them an oval appearance. There are two genera, the octopodous *Pycnogonum* and the decapodous *Pentapycnon:*

1. Four pairs of legs ..... **Pycnogonum** (p. 277)
   Five pairs of legs ..... **Pentapycnon** (p. 281)

Genus PYCNOGONUM Brünnich, 1764

Represented in the western North Atlantic by three species. *Pycnogonum pamphorum* from Brazil is also included in the key as it may be a member of the West Indian fauna.

1. Integument without reticulation 2
   Integument reticulated ..... **reticulatum**, new species (p. 279)
2. Proboscis cylindrical or ovoid 3
   Proboscis tapering to a blunt point ..... **littorale** (p. 277)
3. Without spines on legs; proboscis cylindrical, truncate ..... **crassirostre** (p. 279)
   With a few large spines on femur and tibiae; proboscis ovoid. **pamphorum** Marcus

Mello-Leitão (1945) has proposed another Brazilian species, *Pycnogonum leticiae*, which is very close to if not indentical with *pamphorum*. The only noteworthy difference seems to be the presence of a small tubercle just behind the ocular tubercle in *leticiae*.

PYCNOGONUM LITTORALE (Ström)

FIGURE 52, *a*

Phallangium littorale STRÖM, 1762, p. 209, pl. 1, fig. 17.
Pycnogonum pelagicum STIMPSON, 1853, p. 37.—WHITEAVES, 1872, p. 347.
Pycnogonum littorale VERRILL, 1873b, p. 415.
Pycnogonum pelagicum VERRILL, 1874c, p. 502.
Pycnogonum littorale SMITH and HARGER, 1874, p. 10.—VERRILL, 1875, p. 38.—WILSON, 1878b, pp. 4–5, pl. 1, fig. 1, *a*, *b*; pl. 2, fig. 3, *a*, *b*; 1880, pp. 469–471, pl. 1, figs. 1–3; 1881, p. 242.—VERRILL, 1885, p. 560.—WHITEAVES, 1901, p. 262.—BOUVIER, 1914b, pp. 207–210.—SUMNER, OSBURN, and COLE, 1913, p. 677.—SCHIMKEWITSCH, 1930, pp. 7–15.—STEPHENSEN, 1933, p. 30, fig. 8 (map).—NEEDLER, 1943, p. 5, fig. 3, *a–d*.

ALBATROSS RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
2055	Aug. 30, 1883	42 32 00	68 17 00	99.5	1
2062–63	Aug. 31, 1883			141–150	3
2183	Aug. 2, 1884	39 57 45	70 56 30	195	1♂, 1♀
2469	July 4, 1885	44 58 37	56 20 45	201	2♂♂, 1♀
2470	do	44 47 00	56 33 45	224	2♀♀
2506	July 8, 1885	44 26 00	62 10 00	127	1
2514	July 11, 1885	43 28 30	63 57 30	126	1♂, 1♀
2523	July 13, 1885	41 48 30	65 44 30	111	1
2526	do	41 40 45	65 46 00	121	7
2578	Sept. 4, 1885	41 20 30	68 34 30	37	1♂

Pycnogonum littorale is one of the characteristic denizens of the North Atlantic littoral. On the coast of the United States it is found from Eastport, Maine, to Long Island Sound. The local bathymetric range is from shore line to 810 fathoms. Although Stephensen listed Barbados for this species, it is not represented in the museum collec-

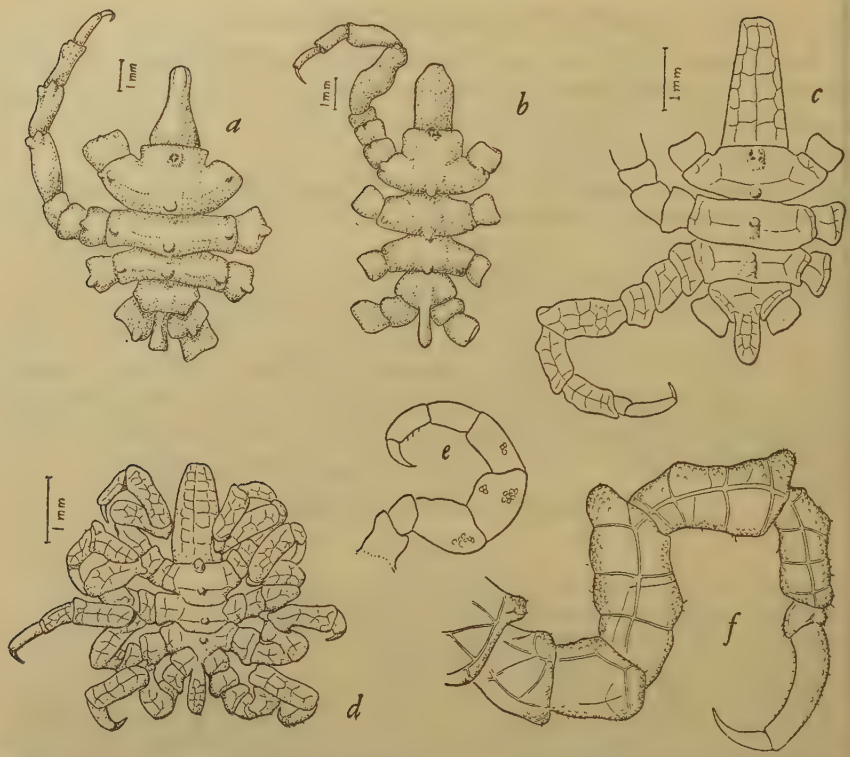

FIGURE 52.—*a*, *Pycnogonum littorale* (Ström); *b*, *P. crassirostre* Sars; *c–f*, *P. reticulatum*, new species: *c*, dorsal view of holotype; *d*, dorsal view of female specimen; *e*, oviger of holotype; *f*, leg of holotype.

tions from the West Indies. On the eastern shore of the Atlantic it occurs as far south as Morocco.

Schimkewitsch suggested that *Pycnogonum stearnsi*, the common *Pycnogonum* of the Pacific coast of North America from Alaska to San Diego, might be a variety of *P. littorale*. His reasons were based on Cole's (1904a, p. 294) comparative table of differences between the two species. Schimkewitsch considered these differences secondary and suggested that transitional types might be expected in a large series.

While I do not pretend that the comparative material at my disposal is extensive (58 specimens of *P. littorale* and 25–30 specimens of *P. stearnsi*), I have noticed no such transitional types. Aside from the considerable difference in size, the most consistent difference between the two species is the shape of the proboscis. This always has the appearance of a flat ellipse from above in *P. stearnsi*, never the downward-pointing funnel shape which is characteristic of *P. littorale*. Bouvier mentions no pronounced variation in the shape of the proboscis in a series of 2,307 specimens of *P. littorale* he examined.

PYCNOGONUM CRASSIROSTRE Sars

FIGURE 52, *b*

Pycnogonum crassirostre SARS, 1888, No. 2; 1891, p. 12, pl. 1, fig. 1, *a–h*.—STEPHENSEN, 1933, pp. 30–32, fig. 8 (map).

FISH HAWK RECORDS

Station No.	Date	Lat. N.	Long. W.	Depth	Number of specimens
		° ′ ″	° ′ ″	*Fathoms*	
945	Aug. 9, 1881	39 58 00	71 13 00	207	1
1154	Oct. 4, 1882	39 55 31	70 39	193	6

ALBATROSS RECORDS

2183	Aug. 2, 1884	39 57 45	70 56 30	195	2♀♀
2185	Aug. 2, 1884	40 00 45	74 54 15	129	1

[Three of these records, stations 945, 1154, and 2185, have been previously published by Stephensen (p. 31) but without station numbers.]

This species is smaller than *Pycnogonum littorale* and is distinguished from that species by the shape of the proboscis.

According to Stephensen, "This species seems to prefer deeper water than *P. littorale*" (p. 31). This is not altogether correct, since *P. littorale* has been dredged from greater depths (to 810 fathoms in American waters) than *P. crassirostre*. It would be more accurate to say that *P. crassirostre* is not known to be a littoral species but appears to be restricted to a bathymetric range of 50–200 fathoms.

PYCNOGONUM RETICULATUM, new species

FIGURE 52, *c–f*

Pycnogonum sp. HEDGPETH, 1947, p. 13, fig. 5, *c*.

Types.—Holotype (male): U.S.N.M. No. 13545, Key West, Fla., 1885, Henry Hemphill coll.[29]

Paratype (female): U.S.N.M. No. 9152, Key West, Fla., April 15–27, 1884 (*Albatross*).

Other records.—Key West, Fla., A. S. Packard coll., 1 female (M. C. Z.), Tortugas, Fla., July–August 1925, H. Boschma coll., from surface of *Maeandra areolata*, 1 female; El Salvador, J. M. Dow coll., 1 male.

Description.—Trunk compact, lateral processes touching. Three dorsal trunk tubercles, not quite so tall as eye tubercle. Eye tubercle

[29] An eminent amateur conchologist in his day, suitably remembered in scientific literature by a species of hermit crab and a genus of little black slugs. His neighbors allege that he inadvertently released a lot of large edible snails in their gardens. The ducks enjoyed them. An obituary note, with portrait and bibliography, will be found in Trans. San Diego Soc. Nat. Hist., vol. 2, No. 1, pp. 58–60, 1914.

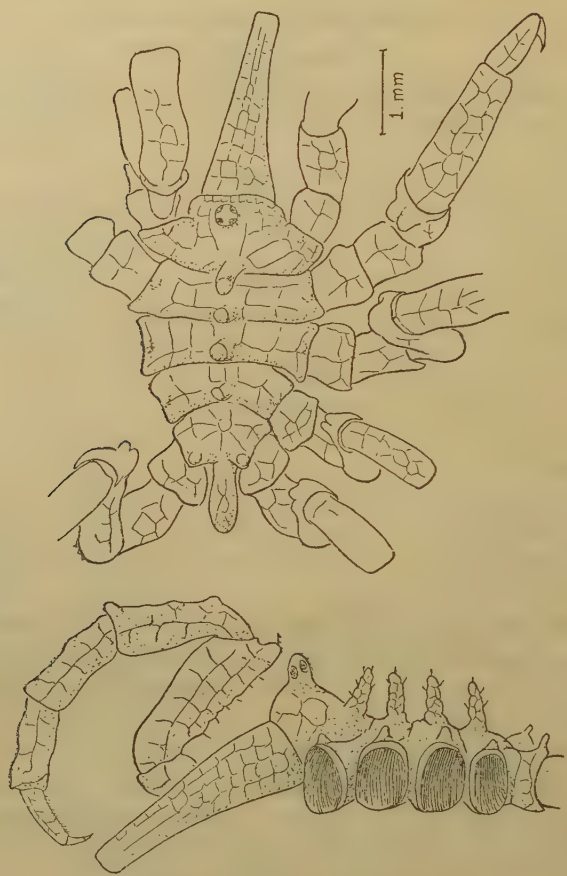

FIGURE 53.—*Pentapycnon geayi* Bouvier.

large, diameter about one-third its height. Integument heavily reticulated by broad chitinous bands, and adorned with numerous small rounded tubercles. There is a small seta at the apex of many of the small tubercles.

Proboscis nearly as long as trunk, tapering slightly from base to tip. Tip broad, obtuse, directed downward.

Abdomen as long as last trunk segment, subcylindrical, rounded at tip.

Oviger 7-jointed, third and fourth joints almost as broad as long. Terminal spine about two-thirds as long as seventh joint.

Leg thick, knobby. Femur not quite so long as the sum of the coxae, tibiae subequal. Tarsus short but distinct. Propodus slightly curved, with a row of weak spines on the sole. Terminal claw less than half as long as the propodus.

Measurements.—As follows:

	Mm.	Third leg:	*Mm.*
Proboscis	2.1	Coxae	1.5
Diameter at base	1.0	Femur	1.25
Trunk	3.0	First tibia	1.0
Cephalic segment	1.0	Second tibia	0.75
Second lateral process, width	2.0	Tarsus	0.1
Abdomen	0.9	Propodus	0.9
		Terminal claw	0.5

Remarks.—Although Hilton's figure (1942b, pl. 48) of his *Pycnogonum panamum* is suggestive of this species, it is actually quite different. The lateral processes of Hilton's species are well separated, the legs slender, and the size of the type specimen is at least half again as large as the specimens of *P. reticulatum*. The integument of *P. panamum* does not have the numerous small tubercles found in this species.

The name for this species was proposed (on labels) by Dr. Leon J. Cole.

Genus PENTAPYCNON Bouvier, 1910

Like *Pycnogonum*, but with five pairs of legs. Two species are known, the tropical American *Pentapycnon geayi*, and the Antarctic *P. charcoti*. *Pentapycnon charcoti* is adorned with large tubercles, which give it a nodular appearance. The relationships of the pentamerous species of *Pentapycnon* with the "normal" Pycnogonums is discussed in some detail in another paper (Hedgpeth, 1947).

PENTAPYCNON GEAYI Bouvier

FIGURE 53

Pentapycnon geayi BOUVIER, 1911a, pp. 491–494; 1911b, p. 1140; 1913, p. 161.

Record of collection.—Johnson-Smithsonian Expedition station 16, Feb. 3, 1933, north of Puerto Rico, lat. 18°31′ N., long. 66′10′15″ W., 38 fathoms, 1 female.

Previously recorded from the vicinity of Cayenne, French Guiana.

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CHART 1.—Dredging stations of the steamer *Albatross* at which pycnogonids were collected, 1883–1887.

CHART 2.—Stations for pycnogonids in the North Atlantic since 1869.

APPENDIX

The station records cataloged in the following tables have been assembled from a number of sources, but particularly Sanderson Smith's station lists for the North Atlantic (1889) and Townsend's dredging records for the *Albatross* (1901). While it is realized that these lists are incomplete, all the published records from major reports on North Atlantic pycnogonids have been included, together with a few individual records of particular interest. Because of the predominantly Arctic character of the records, the inaccessibility of many of the papers, and the taxonomic vagaries indulged in by the Russians (Schimkewitsch, 1930, lumps *Nymphon spinosissimum* and *hirtipes* as *N. spinosum*, and more recent workers are suggesting such species as *N. brevitarse* and *rubrum* as varieties of *grossipes*), their reports have been omitted from this compilation.

Records of the dredging work of the United States Fish Commission in New England waters before 1877 have not been included inasmuch as few of the collections were referred to station numbers on the original labels. The *Speedwell* records have been compiled from a reexamination of the original material, now in the Peabody Museum. Most of this material has previously been reported by Wilson (1880) but without reference to station numbers. It is not practical to indicate these stations on a small-scale chart; all the dredging stations of the Fish Commission up to 1886 will be found in the charts accompanying Sanderson Smith's lists and should be readily accessible to American students.

Errors are inevitable in a compilation of this type, and I can only hope that they are neither numerous nor serious. Several obvious errors in Norman's review (1908) have been corrected to agree with the positions given by Sanderson Smith. Unfortunately, salinity data are unavailable for most of these stations, and so they have been omitted from the remainder. Reference to further information concerning temperature and salinity data of many expeditions in the North Atlantic is published in "International Aspects of Oceanography" (National Academy of Sciences, 1937, pp. 7–19).

Inasmuch as charts of station positions are included in the Norwegian North Atlantic, *Ingolf*, and *Godthaab* reports, and the distribution of the Arctic species seems to be well established, charts of the occurrence of pycnogonids in northern waters have not been prepared. The distribution of many of the Arctic species has been charted in Stephenson's various papers. From Chart 2 of stations in the North Atlantic, it will be seen that there are vast areas from which we have no records of pycnogonids. There are no collections reported for the area between latitudes 10° to 40° N. and longitudes 30° to 60° W., except the *Challenger* station 70, and the paucity of

records in midocean between latitudes 50° and 60° N. is curious in view of the abundant records immediately north of 60°. It is unfortunate that any material which may have been collected by the *Dana* in 1920–22 has not been published, since that vessel ran several series of stations across the middle of the Atlantic and into the Caribbean, and its collections might be expected to fill out some of the blank spaces on the chart. The intensity of dredging operations in the vicinity of the British Isles is not indicated on the chart, inasmuch as much of the work was published in obscure journals of provincial natural-history societies inaccessible to the author. Much of this work has been summarized by Norman (1908). It should be noted that several stations of the *Michael Sars* expedition of 1910 were made off the coast of Africa, a fact evidently overlooked by Giltay (1937) in drawing up his key to West African Nymphons.

As Stephensen (1933) has shown in his reexamination of the material collected by the *Ingolf*, some of the older identifications of critical species are erroneous. On the whole, however, the distribution of these species is probably well established, and reexamination of all the existing collections would not materially alter the picture.

CONTENTS OF THE APPENDIX TABLES

Page

I. Dredging stations of the *Albatross* at which pycnogonids were collected, 1883–1887 295

II. Catalog of stations at which pycnogonids have been collected by various North Atlantic and Arctic expeditions since 1869. [*Stations west of Greenwich and south of lat. 60° N. entered on Chart 2. # Stations on Chart 3. [a] Material personally examined or reported for the first time. Station numbers in parentheses have been assigned for convenience in charting.] 300

**Porcupine*, 1869 300
Whiteaves, 1871 300
**Bache, 1872* [a] 301
**Challenger*, 1873 301
Valorous, 1875 301
Norwegian North Atlantic, 1876–78 (*Vöringen*) 301
Speedwell, 1877–79 [a] 303
William Barents, 1878–79 306
**Blake*, 1878–79 [a] 307
**Blake*, 1880 307
**Knight Errant*, 1880 308
**Travailleur*, 1881 308
**Triton*, 1882 308
**Talisman*, 1883 309
Fish Hawk, 1880–1891 [a] 309
*Rodger (on whaler *Esquimaux*), 1892 311
*State University of Iowa Bahamas Expedition, 1893 [a] 311
**Caudan*, 1895 312
**Ingolf*, 1895–96 312
**Hirondelle*, 1886–88 314

II. Catalog of stations, etc.—Continued Page
Princesse Alice, 1891–1915 314
**Valdivia*, 1898 316
Bruce (on *Blencathra*), 1898 317
Princeton Arctic Expedition, 1899 (whaler *Diana*) 317
Swedish Zoological Expedition, 1899–1900 317
**Michael Sars*, 1900–14 (Norwegian Fisheries) 319
*Ireland Fisheries, 1901–03 322
Belgica, 1905 322
Tjalfe, 1908–09 323
**Michael Sars*, 1910 (Murray and Hjort) 323
**Grampus*, 1912 [a] 323
**Sylvana*, 1913 324
Pourquoi Pas?, 1913 324
**Prince*, 1917 324
**Fish Hawk*, 1901–20 [a] 325
**Vanneau*, 1923–26 326
Dana, 1925 327
Johann Hjort, 1927 327
**Godthaab*, 1928 327
Capt. R. A. Bartlett, 1926–41[a] (*Effie M. Morrissey*) 328
New York Zoological Society, 1929 (tug *Gladisfen*) 331
Loubyrne, 1930 331
*G. Préfontaine, 1932[a] 331
*Johnson-Smithsonian Expedition, 1933[a] 332
**Mercator*, 1935 332
Président Théodore-Tissier, 1935–36 332
*Smithsonian-Hartford Expedition, 1937[a] 333
*#*Atlantis*, 1937–40[a] 333
Allan Hancock Foundation, *Velero III*, 1939 [a] 333
**Pelican*, 1940[a] 334
Casoar, 1936, 1938 334
III. Pelagic records of pycnogonids from *Sargassum* in mid-Atlantic 335
Index to species included in the tables 336

CHARTS

1. Dredging stations of the *Albatross* 290
2. Stations for pycnogonids in the North Atlantic 291
3. Stations for pycnogonids in the Caribbean and Florida keys 294

ABBREVIATIONS USED IN THE TABLES

bil.	biloculina	g.	gravel	rd.	red
bk.	black	glob.	globigerina	rky.	rocky
br.	brown	gn.	green	s.	sand
brk.	broken	gy.	gray	sa.	sabulous (sandy)
bu.	blue	hd.	hard	sft.	soft
c.	clay	lt.	light	sh.	shells
co.	coral	m.	mud	sp.	specks
crs.	coarse	nod.	nodules	st.	stones
dd.	dead	null.	nullipores	stf.	stiff
dk.	dark	oz.	ooze	vol.	volcanic
fn.	fine	p.	pebbles	wh.	white
for.	Foraminifera	r.	rock	yl.	yellow

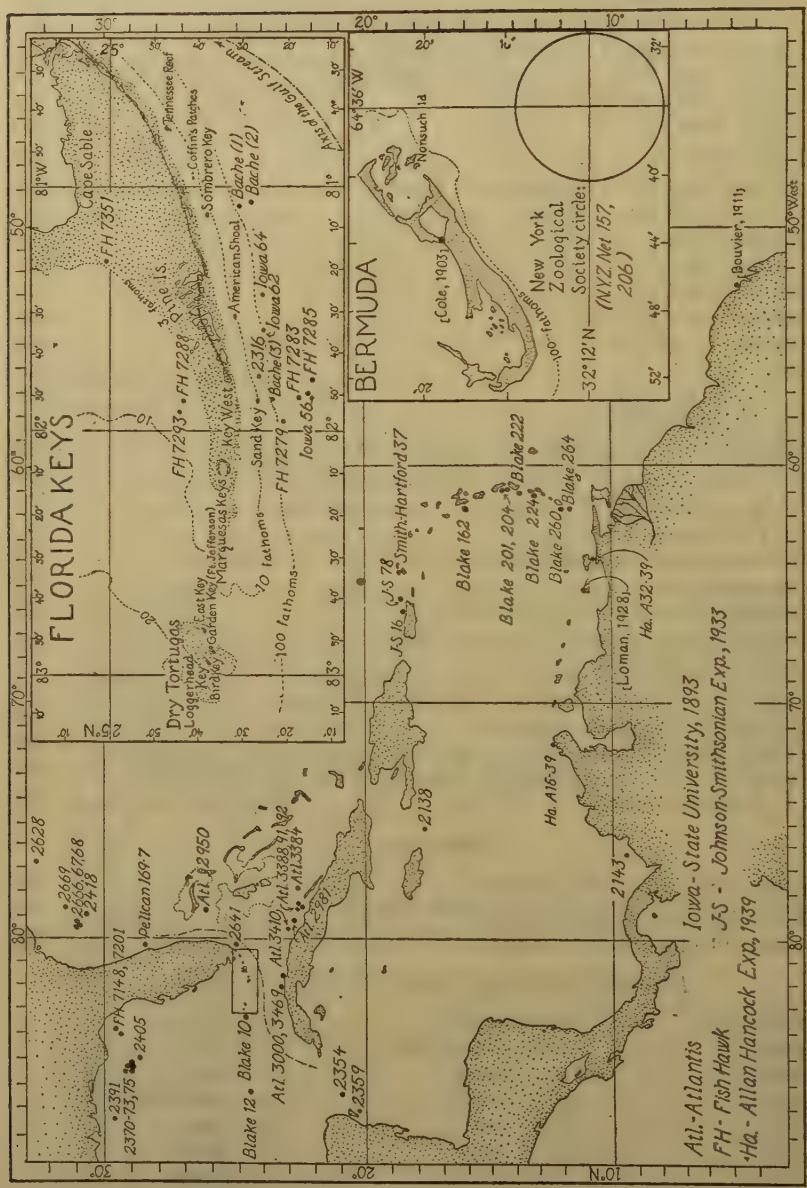

CHART 3.—Stations for pycnogonids in the Caribbean and the Florida keys.

APPENDIX TABLE I

DREDGING STATIONS OF THE ALBATROSS AT WHICH PYCNOGONIDS WERE COLLECTED, 1883–1887

Station No.	Date	Lat. N.	Long. W.	Depth	Temp. ° F.	Type of bottom	Species of pycnogonids
	1883	° ′ ″	° ′ ″	*Fathoms*			
2034	July 17	39 27 10	69 56 20	1,346	38.0	glob. oz	*Colossendeis clavata*
2041	July 30	39 22 50	68 25 00	1,608	38.0	glob. oz	*Colossendeis angusta*
2042	do	39 33 00	68 26 45	1,555	38.5	glob. oz	*Colossendeis angusta*
2043	do	39 49 00	68 25 30	1,467	38.5	glob. oz	*Colossendeis angusta*
2046	July 31	40 02 49	68 49 00	407	40.0	bu. m	*Nymphon strömi; Pallenopsis longirostris*
2050	Aug. 1	39 42 50	69 21 21	1,050	44.5	glob. oz	*Colossendeis angusta, colossea*
2051	do	39 41 00	69 20 20	1,106	39.0	bu. m., glob. oz	*Colossendeis colossea, clavata*
2052	do	39 40 05	69 21 25	1,098	45.0	glob. oz	*Colossendeis colossea*
2055	Aug. 30	42 32 00	68 17 00	99.5		bu. m., s., crs. g	*Pycnogonum littorale*
2057	do	42 01 00	68 00 30	86		crs. s., bk. sp., brk. sh	*Colossendeis angusta*
2062	Aug. 31	42 17 00	66 37 15	150	42.0	s., g	*Nymphon grossipes, strömi; Pycnogonum littorale*
2063	do	42 23 00	66 23 00	141	46.0	s., crs. g	*Pycnogonum littorale*
2064	do	42 25 40	66 08 35	122		crs. s., g	*Nymphon strömi*
2067	Sept. 1	42 15 25	65 48 40	122	46.0	s., g	*Nymphon macrum*
2069	do	41 54 50	65 48 35	101	42.0	s., st., g., p. & c	*Nymphon macrum*
2071	do	41 56 20	65 48 40	113		p. & c	*Nymphon macrum*
2072	Sept. 2	41 53 00	65 35 00	858	39.0	gy. m	*Nymphon tenellum; Colossendeis colossea, macerrima, clavata, michaelsarsi*
2074	Sept 3	41 43 00	65 21 50	1,309	40.0	m., st	*Ascorhynchus armatus; Colossendeis angusta*
2075	do	41 40 30	65 35 00	855	39.0	glob. oz	*Colossendeis clavata*
2076	Sept. 4	41 13 00	66 00 50	906		bu. m	*Colossendeis angusta, clavata*
2077	do	41 09 40	66 02 20	1,255	39.0	bu. m	*Ascorhynchus armatus; Colossendeis colossea*
2078	do	41 11 30	66 12 20	499	40.0	gy. m., s	*Callipallene acus, Colossendeis colossea*
2083	Sept. 5	40 26 40	67 05 15	959	40.0	gy. m	*Colossendeis macerrima*
2084	do	40 16 50	67 05 15	1,290	40.0	bu. m., s	*Ascorhynchus armatus*
2093	Sept. 21	39 42 50	71 01 20	1,000	39.0	for., s., m	*Colossendeis angusta, minuta, macerrima*
2094	do	39 44 30	71 04 00	1,022	38.5	for., s., m	*Colossendeis colossea*
2102	Nov. 5	38 44 00	72 38 00	1,209	39.0	glob. oz	*Colossendeis angusta*
2103	do	38 47 20	72 37 00	1,091	39.0	glob. oz	*Colossendeis angusta, colossea*

APPENDIX TABLE I—Continued

Station No.	Date	Lat. N.	Long. W.	Depth	Temp. ° F.	Type of bottom	Species of pycnogonids
	1883	° ′ ″	° ′ ″	*Fathoms*			
2105	Nov. 6	37 50 00	73 03 50	1,395	41.0	glob. oz	*Colossendeis angusta*
2106	do	37 41 20	73 03 20	1,497	42.5	glob. oz	*Colossendeis angusta*
2110	Nov. 9	35 12 10	74 57 15	516	40.0	bu. m	*Colossendeis colossea*
2111	Nov. 11	35 09 50	74 57 40	938		gn. m	*Nymphon tenellum; Colossendeis angusta, colossea*
2115	do	35 49 30	74 34 45	843	39.0	m., fn. s	*Nymphon macrum; Colossendeis angusta, colossea, macerrima*
2116	do	35 45 23	74 31 25	888	39.0	bu. m., fn. s	*Nymphon macrum*
	1884						
2138	Feb. 29	17 44 05	75 39 00	23		co., brk. sh	*Pallenopsis schmitti*
2143	Mar. 23	9 30 45	76 25 30	155		gn. m	*Pallenopsis schmitti*
2173	July 21	37 57 00	72 34 00	1,600	37.0	glob. oz	*Colossendeis angusta*
2183	Aug. 2	39 57 45	70 56 30	195	44.5	gn. m., s	*Pycnogonum littorale, crassirostre*
2185	do	40 00 45	74 54 15	129	51.0	gn. m., s	*Pycnogonum crassirostre*
2192	Aug. 5	39 46 30	70 14 45	1,060	38.6	gy. oz	*Colossendeis colossea*
2193	do	39 44 30	70 10 30	1,122	38.4	gn. m	*Colossendeis angusta, colossea*
2195	do	39 44 00	70 03 00	1,058	38.4	gn. m	*Colossendeis angusta, colossea*
2196	Aug. 6	39 35 00	69 44 00	1,230	38.0	gn. m	*Colossendeis angusta, colossea, clavata*
2203	Aug. 19	39 34 15	71 41 15	705	38.9	gn. m	*Paranymphon spinosum*
2205	Aug. 20	39 35 00	71 18 45	1,073	38.1	gy. oz	*Ascorhynchus armatus; Colossendeis colossea, angusta, macerrima, clavata*
2207	do	39 35 33	71 31 45	1,061	38.6	gn. m	*Colossendeis clavata*
2209	Aug. 21	39 34 45	71 31 30	1,080	39.5	gn. m., s	*Colossendeis angusta, colossea, clavata*
2210	do	39 37 45	71 18 45	991	38.1	glob. oz	*Colossendeis angusta, colossea, clavata*
2211	do	39 35 00	71 18 00	1,604	38.3	gy. oz	*Colossendeis angusta*
2212	Aug. 22	39 59 30	70 30 45	428	40.0	gn. m	*Nymphon longitarse; Achelia brevichelifera.*
2214	do	35 57 00	70 32 00	475	39.5	gn. m	*Paranymphon spinosum*
2217	Aug. 23	39 47 20	69 34 15	924	38.1	gy. m	*Colossendeis angusta, colossea*
2220	do	39 43 30	69 23 00	1,054	38.3	gy. m	*Colossendeis colossea*
2221	Sept. 6	39 05 30	70 44 30	1,525	36.9	gy. oz	*Colossendeis angusta*
2222	do	39 03 15	70 50 45	1,537	36.9	gy. oz	*Colossendeis angusta*

2230	Sept. 12	39 27 00	73 02 00	1,168	36.8	gy. oz	*Colossendeis colossea*
2231	do	38 29 00	73 09 00	965	36.8	gy. oz	*Colossendeis angusta, colossea*
2232	do	38 37 30	73 11 00	243	42.8	gn. m	*Colossendeis angusta*
2246	do	39 56 45	70 20 30	122	48.8	gn. m	*Nymphon strōmi*
2260	Sept. 28	40 13 15	69 29 15	46	50.2	gy. s	*Nymphon grossipes*
2269	Oct. 19	35 12 30	75 05 00	48	77.0	crs. gy. bk. s	*Anoplodactylus insignis*
2280	do	35 21 00	75 21 30	16		gy. s., brk. sh	*Anoplodactylus lentus*
2307	Oct. 21	35 42 00	74 54 30	43	57.3	gy. bk. s	*Anoplodactylus petiolatus*
	1885						
2316	Jan. 15	24 25 30	81 47 45	50	74.0		*Anoplodactylus lentus*
2354	Jan. 22	20 59 30	86 23 45	130		co	*Anoplodactylus lentus*
2359	Jan. 29	20 19 10	87 03 30	231	50.8	wh. co	*Ascorhynchus serratum*
2370	Feb. 17	29 18 15	85 32 00	25		crs. gy. s., brk. sh	*Anoplodactylus lentus*
2371	do	29 17 00	85 30 45	26		gy. s., brk. sh	*Anoplodactylus lentus*
2372	do	29 15 30	85 29 30	27		g	*Anoplodactylus lentus*
2373	do	29 14 00	85 29 15	25		co	*Anoplodactylus lentus*
2375	do	29 10 00	85 31 00	30		s., bk. sp., brk. sh	*Anoplodactylus lentus*
2391	Mar. 4	29 32 00	87 45 00	25		gy. s., bk. sp	*Anoplodactylus lentus*
2405	Mar. 15	28 45 00	85 02 00	30		gy. s., brk. co	*Nymphon floridanum; Anoplodactylus lentus*
2415	Apr. 1	30 44 00	79 26 00	440	45.6	co., crs. s., sh., for	*Nymphon strōmi*
2428	June 23	42 48 00	50 55 30	826	38.3	gn. m	*Cordylochele malleolata*
2429	do	42 55 30	50 51 00	471	38.7	gy. m	*Nymphon spinosissimum, strōmi, macrum; Cordylochele malleolata*
2430	do	42 58 30	50 50 00	179		gn. s., p	*Nymphon hirtipes; Colossendeis angusta*
2469	July 4	44 58 37	56 20 45	201	40.5	gn. m	*Colossendeis angusta; Pycnogonum littorale*
2470	do	44 47 00	56 33 45	224	40.2		*Pallenopsis longirostris; Colossendeis angusta; Pycnogonum littorale*
2471	do	44 34 00	56 41 45	218	40.4	gy. m., s	*Nymphon spinosissimum, hirtipes, tenellum, macrum; Cordylochele malleolata; Colossendeis angusta*
2484	July 5	44 20 00	57 11 15	204		fn. wh. s	*Nymphon spinosissimum*
2486	do	44 26 00	57 11 15	190	39.7	cr. s., g	*Nymphon spinosissimum*
2506	July 8	44 26 00	62 10 00	127	43.1	dk. br. m	*Pycnogonum littorale*
2508	do	44 28 30	62 56 00	72	39.7	br. m	*Nymphon hirtipes, strōmi*
2514	July 11	43 28 30	63 57 30	126	43.1	bk. m	*Pycnogonum littorale*
2517	July 12	43 10 00	64 18 00	55	38.3	yl. s., bk. sp	*Nymphon strōmi*
2518	do	43 05 00	64 40 30	60	38.7	st	*Nymphon strōmi*
2521	do	42 30 30	65 02 00	65	42.1	s., g	*Nymphon grossipes*
2522	do	42 20 00	65 07 30	104	46.7	s., g	*Nymphon strōmi*

APPENDIX TABLE I—Continued

Station No.	Date	Lat. N.	Long. W.	Depth	Temp. ° F.	Type of bottom	Species of pycnogonids
	1885	° ′ ″	° ′ ″	*Fathoms*			
2523	July 13	41 48 30	65 44 30	111	41.6	s., g., st	*Nymphon strömi; Pycnogonum littorale*
2525	do	41 49 00	65 49 30	72	42.6	s., g., brk. sh	*Nymphon grossipes*
2526	do	41 40 45	65 46 00	121		p	*Pycnogonum littorale*
2528	do	41 47 00	65 37 30	677	38.7	br. s	*Nymphon tenellum; Cordylochele malleolata*
2530	July 14	40 53 30	66 24 00	956	38.4	gy. oz	*Colossendeis colossea, macerrima*
2532	do	40 34 30	66 48 00	705	38.7	gy. m	*Colossendeis colossea*
2533	July 15	40 16 30	67 26 15	828	38.7	br. oz	*Colossendeis colossea, macerrima*
2534	do	40 01 00	67 29 15	1,234	37.8	gy. oz	*Colossendeis angusta*
2535	do	40 03 30	67 27 15	1,149	37.8	gy. oz	*Colossendeis angusta*
2547	Aug. 8	39 54 30	70 20 00	390	39.6	gn. m	*Paranymphon spinosum*
2550	Aug. 9	39 44 30	70 39 45	1,081	38.5	br. m	*Colossendeis angusta, colossea*
2554	do	39 48 30	70 40 30	445	39.6	gn. m	*Pallenopsis longirostris*
2562	Aug. 11	39 15 30	71 25 00	1,434	37.3	gy. oz	*Colossendeis angusta*
2563	do	39 18 30	71 23 30	1,422	37.4	gy. oz	*Colossendeis angusta*
2564	do	39 22 00	71 23 30	1,390	37.3	gy. oz	*Colossendeis angusta*
2571	Sept. 1	40 09 30	67 09 00	1,356	37.8	gy. glob. oz	*Callipallene acus; Colossendeis angusta*
2572	Sept. 2	40 29 00	66 04 00	1,769	37.8	gy. oz	*Colossendeis angusta*
2573	do	40 34 18	66 09 00	1,742	37.3	gy. m. oz	*Colossendeis angusta*
2575	Sept. 3	41 07 00	65 26 30	1,710	37.1	gy. oz	*Colossendeis angusta*
2578	Sept. 4	41 20 30	68 34 30	37	54.4	fn wh. s., bk. sp	*Pycnogonum littorale*
2589	Sept. 21	38 55 00	72 50 30	231	44.2	gn. m., s	*Colossendeis macerrima*
2596	Oct. 17	38 08 30	75 10 00	49		gy. s	*Anoplodactylus lentus*
2628	Oct. 21	32 24 00	76 55 30	528		yl. m	*Pallenopsis longirostris*
	1886						
2641	Apr. 9	25 11 30	80 10 00	60	69.2	co., s	*Pallenopsis schmitti*
2666	May 5	30 47 30	79 49 00	270	48.3	gy. s	*Nymphon strömi; Cordylochele longicollis; Pallenopsis forficifer*
2667	do	30 53 00	79 42 30	273	48.7	gy. s., br., sp	*Nymphon strömi; Cordylochele longicollis; Pallenopsis forficifer*
2668	do	30 58 30	79 38 30	294	46.3	gy. s., dd. co	*Pallenopsis forficifer*
2669	do	31 09 00	79 33 30	352	43.7	gy. s., dd. co	*Nymphon strömi; Pallenopsis forficifer*
2678	do	32 40 00	76 40 30	731	38.7	lt. gy. oz	*Colossendeis macerrima*

2680	July 16	39 50 00	70 26 00	555			*Paranymphon spinosum*
2681	do	39 43 00	70 29 00	990		gn. m	*Colossendeis colossea*
2682	do	39 38 00	70 22 00	1,004		gn. m. s	*Colossendeis angusta*
2683	July 17	39 33 00	70 50 00	887		br. oz	*Colossendeis colossea*
2684	do	39 35 00	70 54 00	1,106		br. c., bk. sp	*Colossendeis angusta, colossea*
2687	July 18	39 46 00	71 19 00	326		gn. m	*Nymphon strömi*
2694	Aug. 11	46 52 30	44 54 30	86		gy. s., bk. sp	*Nymphon grossipes*
2696	do	46 53 30	46 05 30	98		gy. s., bk. sp	*Nymphon grossipes, longitarse*
2698	Aug. 22	45 07 00	55 09 10	90		gy. s., bk. sp	*Nymphon strömi*
2699	do	45 04 00	55 23 00	72		co	*Nymphon grossipes; Pallenopsis longirostris*
2703	Aug. 23	44 10 00	59 02 30	140		gy. s., bk. sp	*Nymphon strömi*
2706	Aug. 27	41 28 30	65 35 30	1,188		gy. oz., for	*Ascorhynchus armatus; Colossendeis angusta*
2710	Aug. 28	40 06 00	68 01 30	984		gn. m	*Colossendeis angusta, colossea*
2711	Sept. 16	38 59 00	70 07 00	1,544		glob. oz	*Colossendeis angusta*
2725	Oct. 24	36 34 00	73 48 00	1,374		gy. oz., for	*Ascorhynchus armatus; Colossendeis angusta, colossea; macerrima*
2727	do	36 35 00	74 03 30	1,239		gy. oz	*Colossendeis colossea*
2728	Oct. 25	36 30 00	74 33 00	859		gy. oz	*Colossendeis colossea, minuta*
2731	do	36 45 00	74 28 00	781		gy. oz	*Ascorhynchus armatus; Colossendeis angusta, colossea*
2732	Oct. 26	37 27 00	73 33 00	1,152		dk. gn. m	*Colossendeis angusta*
2734	do	37 23 00	73 53 00	841		sft. gn. m	*Pallenopsis longirostris; Colossendeis colossea, macerrima, minuta*
2735	do	37 23 00	74 02 00	811		sft. gn. m	*Colossendeis minuta*
	1887						
2739	Sept. 17	37 34 30	73 58 00	811	38.2	gy. m	*Colossendeis colossea*
2748	Sept. 19	39 31 00	71 14 30	1,163	37.8	gy. m., for	*Colossendeis angusta*

APPENDIX TABLE II

CATALOG OF STATIONS AT WHICH PYCNOGONIDS HAVE BEEN COLLECTED BY VARIOUS NORTH ATLANTIC AND ARCTIC EXPEDITIONS SINCE 1869

Porcupine, 1869 (Norman, 1908. Locations for *Nymphon grossipes* not given)

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
	1869	° ′ ″	° ′ ″ W.	*Fathoms*	°*F.*		
17		54 28	11 44	1,230			*Paranymphon spinosum*
45	July 30	51 01	11 21	458			*Pycnogonum littorale*
47	August	59 34	7 18	542			*Nymphon leptocheles*
51	do	60 06	8 14	440			*Nymphon tenellum*
52	do	60 25	8 10	384			*Boreonymphon robustum*
55	do	60 04	6 19	605			*Boreonymphon robustum; Nymphon elegans*
59	August 20	60 21	5 41	580			*Boreonymphon robustum*
61	August 24	62 01	5 19	114			*Boreonymphon robustum*
64	August 25	61 21	3 44	640			*Boreonymphon robustum; Nymphon hirtipes, stenocheir; Cordylochele malleolata*
65	August 26	61 10	2 21	345			*Boreonymphon robustum; Nymphon hirtipes*
66	do	61 15	1 44	267			*Nymphon strömi*
74	September 1	60 39	3 09	203			*Cordylochele malleolata*
78	do	60 14	4 30	290			*Nymphon hirtipes, spinosissimum*
88	September 6	59 26	8 23	705			*Nymphon hirtipes, spinosissimum*

Whiteaves, 1871 (Whiteaves, 1872, pp. 347, 349)

	1871	[ANTICOSTI ISLAND]				
	August	Off E. end of island	212			*Pycnogonum littorale*
	do	Off Cap Rosier	125			*Nymphon strömi*

Bache, 1872 (Hedgpeth, 1943b)

	1872	[Florida Keys]					
(1)	April 2	Off Sombrero Key					*Anoplodactylus polignaci; Ascorhynchus colsi*
(2)	April 4	do		240			*Pallenopsis forficifer*
(3)	April 13	Off Sand Key		104			*Pentacolossendeis reticulata*

Challenger, 1873 (Hoek, 1881)

	1873		W.				
49	May 20	43 03	63 39	83	35.0	g., st	*Nymphon grossipes, macrum*
50	May 21	42 08	63 39	1,250	38.0	bu. m	*Colossendeis minuta*
70	June 26	38 25	35 50	1,675		glob. oz	*Pallenopsis oscitans (longirostris?)*

Valorous, 1875 (Norman, 1908)

1	1875	70 30	54 51	175		s. m	*Nymphon hirtipes, serratum; Pseudopallene circularis*
4	1875	67 56	55 27	20		brk. sh	*Nymphon grossipes (glaciale)*

Norwegian North Atlantic, 1876–78 (Sars, 1891; with map)

	1876		E.		° *C.*		
18	June 26	62 44	1 48	412	−1.0	c	*Boreonymphon robustum; Nymphon elegans, macronyx; Colossendeis proboscidea*
31	June 29	63 10	5 00	417	−1.0	sa. c	*Nymphon grossipes (mixtum), elegans, megalops; Colossendeis angusta*
			W.				
35	July 5	63 17	1 27	1,081	−1.0	bil. c	*Ascorhynchus abyssi*
48	August 8	64 36	10 22	299	−0.3	dk. gy. c	*Nymphon elegans, megalops, hirtipes; Boreonymphon robustum*
			E.				
53	August 10	65 13	0 33	1,539	−1.3	bil. c	*Ascorhynchus abyssi*

APPENDIX TABLE II—Continued

Norwegian North Atlantic, 1876–78—Continued

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
	1877	° ′ ″	° ′ ″ E.	*Fathoms*	°*C.*		
124	June 19	66 41	6 59	350	−0.9	crs. c	*Nymphon elegans, macronyx*
137	June 21	67 24	8 58	452	−1.0	c	*Nymphon macronyx; Colossendeis angusta*
164	do	68 21	10 40	457	−0.7	s. c	*Nymphon elegans*
190	July 7	69 41	15 51	870	−1.2	sa. c	*Nymphon macronyx*
192	do	69 46	16 15	649	−0.7	sa. c	*Nymphon macronyx; Boreonymphon robustum*
200	July 17	71 25	15 41	620	−1.0	c	*Nymphon megalops*
205	July 18	70 51	13 03	1,287	−1.2	bil. c	*Ascorhynchus abyssi*
223	August 1	70 45	8 24	70	−0.6	dk. g. sa. c	*Nymphon grossipes (mixtum), hirtipes*
	1878						
262	June 27	70 36	32 35	148	1.9	c	*Nymphon elegans, hirtipes, macronyx*
267	June 29	71 42	37 01	148	−1.4	c., st	*Nymphon hirtipes*
270	June 30	72 47	35 01	136	0.0	c	*Nymphon hirtipes*
273	July 1	73 25	31 30	197	2.2	c	*Nymphon grossipes (mixtum), hirtipes*
275	July 2	74 08	31 12	147	−0.4	c	*Nymphon elegans, hirtipes*
286	July 6	72 57	14 32	447	0.8	c	*Nymphon macronyx*
290	July 7	72 27	20 51	191	3.5	sa. c	*Nymphon grossipes (mixtum), sluiteri, leptocheles, macrum, hirtipes; Eurycyde hispida; Cordylochele malleolata*
303	July 19	75 12	3 02	1,200	−1.6	bil. c	*Ascorhynchus abyssi*
312	July 22	74 54	14 53	658	−1.2	c	*Nymphon elegans; Colossendeis angusta*
315	do	74 53	15 55	180	2.5	c. s	*Nymphon elegans, serratum*
326	Aug. 3	75 31	17 50	123	1.6	c	*Nymphon hirtipes*
336	Aug. 5	76 19	15 42	70	0.4	c. hd	*Nymphon longitarse, hirtipes*
338	Aug 6	76 19	18 01	146	−1.1	hd	*Nymphon serratum, hirtipes*
343	Aug. 7	76 34	12 51	743	−1.2	c	*Nymphon elegans, megalops, macronyx*
353	Aug. 10	77 58	5 10	1,333	−1.4	bil. c	*Ascorhynchus abyssi*
362	Aug. 14	79 59	5 40	459	−1.0	c	*Nymphon strömi (gracilipes), macronyx; Boreonymphon robustum; Cordylochele malleolata*
363	do	80 03	8 28	260	1.1	c	*Boreonymphon robustum; Nymphon strömi (gracilipes), elegans, hirtipes; Cordylochele malleolata*

Speedwell, 1877–79 (Station data: Sanderson Smith, 1889—with charts)

	1877	W.			F.		
4	Aug. 4	Massachusetts Bay		22	45.?	g	*Nymphon grossipes*
7	do	do				s. & m	*Nymphon grossipes, longitarse*
8	Aug. 6	do		20	55	r	*Nymphon grossipes; Tanystylum orbiculare*
9	do	do		25	52.5	g	*Nymphon grossipes*
10	do	do		20.5	50.5	g	*Nymphon grossipes*
19	Aug. 8	do		45		m	*Nymphon longitarse*
21	Aug. 10	do		26		hd. g. st	*Nymphon strömi*
22	do	do		26		hd. g. st	*Nymphon grossipes*
23	do	do		35		m., c. nod	*Nymphon grossipes, strömi, longitarse*
24	Aug. 13	42 30	70 41	33	49.5	sft. m	*Nymphon longitarse*
28	do	Massachusetts Bay		48		sft. m	*Nymphon longitarse*
29	do	do		48		sft. m	*Pycnogonum littorale*
30	do	do		50		m	*Nymphon grossipes, strömi, longitarse*
31	do	do		48–50		m	*Nymphon longitarse*
32	Aug. 14	42 30	70 20	90	38.5–39	m	*Nymphon strömi, longitarse; Pycnogonum littorale*
33	do	42 30	70 20	90		m	*Nymphon strömi, grossipes*
35	Aug. 19	42 37	69 39	160		m	*Nymphon longitarse*
37	Aug. 20	42 39	66 58	115	38–39	g	*Nymphon grossipes*
38	do	42 42	66 58	112		g	*Nymphon macrum*
41	do	42 49	66 19	82		r. barn	*Pycnogonum littorale*
42	Aug. 21	43 03½	65 01½	88	33.5–41	fn. s	*Pycnogonum littorale*
43	do	43 05½	65 02	90			*Nymphon longitarse*
47	do	43 10	65 12½	59		p. & s	*Nymphon longitarse, strömi*
48	do	43 11	65 14½	59		r	*Nymphon longitarse; Pcynogonum littorale*
49	do	43 13	65 17	56	31.5–40	hd	*Phoxichilidium femoratum*
53	Aug. 25	Halifax, N. S		35	34.0	m	*Nymphon grossipes*
54	do	do		35		m	*Nymphon strömi*
59	Aug. 28	do		25	43.5	g	*Nymphon grossipes*
62	do	do		20	47.–48.5	shingle	*Nymphon grossipes, longitarse*
63	Aug. 29	do		26	34.5–35		*Nymphon grossipes*
64	do	do		40		m	*Nymphon longitarse*
65	do	do		40			*Nymphon longitarse*
68	do	do		16	44⅔–45		*Nymphon grossipes, longitarse*

APPENDIX TABLE II—Continued

Speedwell, 1877–79—Continued

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
	1877	° ′ ″	° ′ ″ W.	*Fathoms*	°*F.*		
78	Sept. 5	Chebucto Head, N. S.		25	33.–37½	r. null	*Nymphon grossipes, longitarse*
80	do	44 22	63 28	57	32¾–35¾	m. p	*Nymphon hirtipes*
81	do	Chebucto Head, N. S.		57		st. sp. rd. al	*Nymphon hirtipes*
85	Sept. 6	do		101			*Nymphon grossipes, longitarse*
86	do	do					*Nymphon grossipes, longitarse*
95	Sept. 13	Halifax, N. S.				fn. s., oz	*Nymphon grossipes*
101	Sept. 15	do		42		fn. s	*Nymphon hirtipes*
102	do	do		42		r. & s	*Nymphon hirtipes*
110	Sept. 21	do		37			*Nymphon hirtipes*
112	Sept. 24	Chebucto Head, N. S.		52	35	fn. s. m	*Nymphon hirtipes*
113	do	do		52	35	fn. s. m	*Nymphon hirtipes, longitarse*
115	do	do		52		fn. s. m	*Nymphon strömi*
118	do	do		53		s. m. r.	*Nymphon grossipes, hirtipes*
121	Sept. 27	Halifax, N. S.		43			*Nymphon grossipes*
124	Oct. 17	42 32	70 22½	51	45	m. g. r	*Nymphon grossipes, longitarse*
127	do	Off Cape Ann		75			*Nymphon strömi, longitarse*
	1878						
133	July 23	42 32	70 38½	33		rky	*Nymphon grossipes*
135	July 29	42 32½	70 38½	25	40.5	s. & g	*Nymphon grossipes*
140	do	42 34	70 32	38	40	m	*Nymphon longitarse*
149	Aug. 3	Massachusetts Bay		19½	42	s. & g	*Nymphon grossipes*
152	do	do				s. & m	*Nymphon strömi*
154	Aug. 15	42 35	70 31	38	41.5	p. crs. s	*Nymphon longitarse*
155	do	42 35	70 30	42		m	*Nymphon longitarse*
156	do	Massachusetts Bay		42	41.5	s. & m	*Nymphon grossipes, longitarse, strömi*
158	do	do		38		m. rks	*Nymphon longitarse*
161	Aug. 16	do		54		fn. s	*Nymphon longitarse, strömi*
163	do	do		73		fn. s	*Nymphon longitarse*
164	do	do		75	40	fn. s	*Nymphon longitarse, strömi*
169	Aug. 19	do		19	40¼	s	*Phoxichilidium femoratum*

170	Aug. 24	42 33	69 59	90		40	s. m. g	*Nymphon strömi, macrum*
171	do	Massachusetts Bay		90		39	s. st	*Nymphon strömi*
172	do	42 33	69 57	115				*Nymphon macrum*
182	Aug. 29	Massachusetts Bay					m	*Nymphon grossipes, longitarse*
184	do	do		110		42½	m	*Nymphon grossipes, longitarse, strömi*
187	Aug. 31	do		110			sft. b. m	*Nymphon grossipes, macrum; Pycnogonum littorale*
188	do	42 33½	69 58½	85		40	s. m. g	*Nymphon macrum; Pycnogonum littorale*
189	do	Massachusetts Bay		85		40	g. p	*Nymphon grossipes*
191	do	do		100			sft. br. m	*Nymphon strömi*
192	do	do		100-110			sft. br. m	*Nymphon strömi*
197	Sept. 2	42 25½	70 23	23		54.5	st. sp	*Nymphon grossipes*
210	Sept. 17	42 38	70 28½	60		43	sft. dk. b. m	*Nymphon longitarse, strömi*
211	do	Off Cape Ann		60			sft. dk. b. m	*Nymphon strömi*
213	do	do		68			m. & conc	*Nymphon strömi*
214	do	do		57			fn. m. s	*Nymphon strömi*
216	Sept. 18	42 30	70 32	35			s	*Nymphon longitarse, strömi*
217	do	42 30	70 35	45			sft. dk. b. m	*Nymphon macrum*
219	do	42 30	70 33	32		55.5	rky. st	*Nymphon grossipes, longitarse*
226	Sept. 23	42 36	70 36	18			rky	*Nymphon grossipes*
227	do	42 33½	70 40	23		58	r. s. g	*Nymphon grossipes*
229	do	Massachusetts Bay		19			rky., crs. s	*Nymphon grossipes; Pycnogonum littorale*
233	Sept. 24	do		45			sft. b. m	*Nymphon strömi*
234	do	do		43			sft. b. m	*Nymphon grossipes, longitarse, strömi*
237	Sept. 26	42 31	70 29	38		49¾	crs. s., g	*Nymphon longitarse*
	1879							
258	July 28	41 55	70 20	20			sft. m	*Nymphon grossipes*
264	July 29	42 10	69 56½	80			bu. m	*Nymphon strömi; Pycnogonum littorale*
277	Aug. 1	42 02	70 15	28		42	s., sh	*Nymphon grossipes*
291	Aug. 11	42 04½	70 16½	30		40	fn. g., s	*Nymphon grossipes; Achelia spinosa*
326	Sept. 1	42 14½	70 02	75		40.5	gn. m	*Nymphon longitarse, strömi; Pycnogonum littorale*
329	Sept. 6	42 00	70 12	26		42.	fn. b. s., p	*Nymphon grossipes*
364	Sept. 18	41 58½	69 44	70			hd. s., br. sh	*Nymphon strömi; Pycnogonum littorale*
365	Sept. 19	41 38	65 53	7½			crs. s	*Nymphon strömi*
370	do	41 35½	69 42	18			crs. s., g	*Nymphon grossipes*
371	do	41 35½	69 35	34½			crs. sp. s	*Nymphon grossipes*
378	Sept. 26	42 04¼	69 39	96			b. m	*Nymphon grossipes*

APPENDIX TABLE II—Continued

***William Barents*, 1878–79 (Hoek, Niederl. Arch. Zool., Suppl. 1:1–26)**

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
		° ′ ″	° ′ ″ E.	*Fathoms*	°*C.*		
	1878						
3	July 15	74 20	18 30	25			*Nymphon grossipes*
6	July 25	72 05	37 57	160			*Nymphon hirtipes*
8	July 29	74 09	42 02	160			*Boreonymphon robustum; Nymphon hirtipes, strömi; Colossendeis proboscidea*
9	July 30	75 16	45 19	100	−1.3		*Boreonymphon robustum; Nymphon hirtipes, strömi, serratum, sluiteri*
10	July 31	76 31	45 36	130	−1		*Colossendeis proboscidea*
11	Aug. 1	77	45 48	110	−0.6		*Nymphon strömi; Colossendeis proboscidea*
13	Aug. 13	73	43	120			*Nymphon hirtipes*
14	Aug. 23	73 25	±55	2–12			*Nymphon grossipes*
	1879						
5	July 14	72 32.3	36 39.5	128	1.2		*Boreonymphon robustum; Nymphon hirtipes*
6	July 17	74 05	37 31.5	124	−0.2		*Boreonymphon robustum; Colossendeis proboscidea*
7	July 19	75 23.5	38 39.5	88	−1.1		*Nymphon hirtipes*
8	July 21	76 05.3	42 08	150	−1		*Nymphon hirtipes, strömi*
10	July 24	73 42.5	43 38.5	145	0.6		*Boreonymphon robustum; Nymphon hirtipes*
12	July 30	71 06	50 20	62	−0.1		*Nymphon hirtipes*
13	July 31	71 23	49 38	67	1		*Nymphon hirtipes, grossipes, longitarse*
14	Aug. 13	73 10	57	2–11	0		*Nymphon longitarse*

Blake, 1878–79 (Hedgpeth, 1943b)

			W.	°F			
	1878						
10		24 44 00	83 26 00	37			*Pallenopsis schmitti; Anoplodactylus lentus*
12		24 34 00	86 16 00	36			*Anoplodactylus insignis*
	1879						
162	Jan. 19	16 02 40	61 50 28	734		la. s.	*Colossendeis colossea*
201	Feb. 9	14 34 40	61 08 25	565	40.5	dk. gy. oz.	*Ephyrogymna circularis*
204	Feb. 10	14 24 55	61 00 05	476	42.5	fn. s., br. sh.	*Heterofragilia fimbriata*
222	Feb. 16	13 58 37	61 04 45	422	56.0	s., oz.	*Colossendeis colossea*
227	Feb. 19	13 10 10	61 18 15	572	39.5	s., oz.	*Colossendeis colossea*
260	Feb. 28	12 03 30	61 47 10	291	47.0	s., oz.	*Pallenopsis forficifer*
264	Mar. 1	12 03 15	61 48 30	416	42.5	gy. oz.	*Pallenopsis forficifer*

Blake, 1880 (Wilson, 1881)

	1880						
302	June 28	41 30 00	66 00 00	73	42.5	yl. s., bk. sp.	*Pycnogonum littorale*
303	do	41 34 30	65 54 30	306	40.5	gy. s., bk. sp.	*Pycnogonum littorale*
304	do	41 35 00	65 57 30	139	44		*Pycnogonum littorale*
305	do	41 33 15	65 51 25	810	39.0	dk. gy. m., s. st.	*Colossendeis angusta, colossea; Pycnogonum littorale*
306	June 29	41 32 50	65 55 00	524	39.5	dk. gy. m.	*Nymphon grossipes, strömi; Colossendeis colossea*
307	do	41 29 45	65 47 10	980	38.0	dk. gy. m.	*Colossendeis colossea*
308	do	41 24 45	65 35 30	1242	38.0	dk. gy. m.	*Ascorhynchus armatus; Colossendeis angusta*
310	July 1	39 59 00	70 18 45	260	42.0	gn. m.	*Nymphon strömi*
317	July 12	31 57 00	78 18 35	334	45.0	hd.	*Pallenopsis forficifer*
318	do	31 48 50	77 51 50	337	47.0	co., sh.	*Pallenopsis forficifer*
338	July 18	38 18 40	73 18 10	922	39.0	glob. oz.	*Nymphon tenellum; Colossendeis angusta, macerrima*
339	do	38 16 45	73 10 30	1186	39.0	glob. oz.	*Colossendeis colossea*
342	July 20	39 43 00	70 55 25	1002	39.0	bu. c.	*Colossendeis colossea*

APPENDIX TABLE II—Continued

Knight Errant, 1880 (Hoek, 1881, pp. 94–99)

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
	1880	° ′ ″	° ′ ″ W.	*Fathoms*	°*F.*		
2	July 28	60 29	8 19	375	31.0	m	*Boreonymphon robustum*
3	August 3	59 12	5 57	53		m	*Pycnogonum littorale*
5	August 11	59 26	7 19	515	44.0	oz	*Nymphon strömi*
7	do	59 37	7 19	530		oz	*Nymphon strömi*
8	August 17	60 03	5 51	540	28.0	oz	*Boreonymphon robustum; Nymphon grossipes, strömi, macronyx; Colossendeis proboscidea*

Travailleur, 1881 (Bouvier, 1916a)

	1881		E.	*Meters*			
	July 6	43 00	03 22	445		m	*Anoplodactylus massiliensis*
			W.	*Fathoms*			
38	August 14	44 11 00	8 13 15	1,048		m	*Colossendeis macerrima (villegenti)*

Triton, 1882 (Hoek, 1883)

	1882			*Fathoms*			
5		60 11 45	8 15 00	433	43.5	hd	*Nymphon hirtipes*
6		60 09 00	7 16 30	466	29.5–30	st	*Boreonymphon robustum; Nymphon grossipes, strömi, macronyx; Colossendeis angusta*
8		60 18 00	6 15 00	640	30.0	m	*Boreonymphon robustum; Nymphon strömi, macronyx; Colossendeis angusta*
9		60 05 00	6 21 00	608	30.0	m	*Boreonymphon robustum; Nymphon grossipes, strömi, macronyx; Colossendeis proboscidea*
10		59 40 00	7 21 00	516	46–46.5	m	*Boreonymphon robustum; Nymphon grossipes, macrum, macronyx; Cordylochele malleolata; Pallenopsis tritonis*
11		59 39 30	7 13 00	555	45.5	oz	*Nymphon longitarse, macrum*

Talisman, 1883 (Bouvier, 1916b, 1937)[a]

	1883			Meters	°C		
16	June 13	34 01	8 32	2,190	4.5	m	*Colossendeis colossea*
33 [32]	June 17	32 34	9 49	1,590		m	*Colossendeis angusta*
34 [33]	do	32 31	9 48	1,350		gsy. m	*Colossendeis michaelsarsi*
41 [38]	June 23	30 09	11 41	2,210	4.0	m	*Colossendeis macerrima*
42 [39]	do	30 08	11 42	2,200		gsy. m	*Colossendeis colossea*
45 [41]	June 24	30 01	11 46	2,115		gy. m., brk. sh	*Colossendeis macerrima*
46 [42]	June 25	29 58	11 41	2,104		gsy. m	*Colossendeis colossea*
52 [48]	June 26	29 01	12 31	1,180	8.5	m	*Colossendeis colossea*
53 [49]	June 27	28 37	13 02	865	7.0	yl. m	*Colossendeis colossea*
76 [73]	July 9	25 39	16 06	1,435		yl. m	*Colossendeis colossea*
81 [79]	July 11	23 57	17 12	1,400	5.2	yl. m	*Colossendeis angusta, macerrima*
83 [80, 81]	do	23 52	17 07	1,250	6.0	gy. m	*Colossendeis angusta, macerrima*
85 [82]	July 12	23 00	17 30	932	7.0	gr. m., s	*Colossendeis angusta, macerrima*
96 [93]	July 14	20 44	18 07	1,495	4.5	gr. m., s	*Colossendeis angusta*
98 [95]	do	20 38	18 19	1,230		gr. m., s	*Colossendeis angusta*
103 [99]	July 17	17 12	17 07	1,617		gr. m	*Colossendeis macerrima*
104 [100]	do	17 16	16 59	1,550		gr. m	*Ascorhynchus armatus*
113 [105]	July 27	Bt. Branco & Razo, Cape Verde Is.		80–110		s., r	*Achelia echinata*
118 [112]	July 30	16 51	25 09	405	11.5	r	*Achelia armata*
120 [118]	do	16 53	25 12	618		m., s	*Endeis charybdaea bispinata*
146 [133]	Aug. 24	42 15	21 17	3,975	3.0	sft. wh. m	*Colossendeis gigas-leptorhynchus*
147 [134]	do	42 19	21 16	4,060	3.0	sft. wh. m	*Colossendeis colossea*
149 [315]	Aug. 25	43 15	19 20	4,165	2.9	sft. wh. m	*Colossendeis gigas-leptorhynchus*

Fish Hawk, 1880–91

	1880			Fathoms	°F		
775	Aug. 6	Narragansett Bay		12	68.0	g., s., m	*Anoplodactylus lentus*
786	Aug. 12	do		19	53.5	m., fn. s	*Anoplodactylus lentus*
824	Aug. 24	Long Island Sound		13	67.0	s	*Callipallene brevirostris*
891	Oct. 2	39 46 00	71 10 00	480?		sft. b. m	*Pallenopsis longirostris*
894	do	39 53 00	70 58 30	365	40.0	b. m., st	*Paranymphon spinosum*

APPENDIX TABLE II—Continued

Fish Hawk, 1880–91—Continued

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
		° ′ ″	° ′ ″ W.	*Fathoms*	°*F.*		
	1881						
928	July 20	Vineyard Sound		10	60.0	s	*Callipallene brevirostris; Tanystylum orbiculare*
933	do	do		14	64.0	st	*Tanystylum orbiculare*
934	do	do		9	67.0	s., g	*Tanystylum orbiculare*
945	Aug. 9	39 58 00	71 13 00	207	44.0	gn. m., s	*Nymphon strömi; Pycnogonum crassirostre*
965	Aug. 30	Off Cape Cod		15	53.0	s., g	*Nymphon longitarse*
1028	Nov. 14	39 57	69 17	410	41.0	yl. m	*Achelia brevichelifera*
1041	Nov. 22	Vineyard Sound		9	65.0	s., g	*Tanystylum orbiculare*
	1882						
1093	July 11	39 56	69 45	349	40.0	bu. m., s	*Paranymphon spinosum*
1096	Aug. 11	39 53	69 47	317	40.0	gn. m	*Colossendeis macerrima*
1121	Aug. 26	40 04	68 49	234	41.5	fn. s., st	*Nymphon strömi*
1122	do	40 02	68 50	351	40.5	fn. s., st	*Nymphon strömi*
1123	do	39 59 45	68 54	787	39.0	fn. s., gn. m	*Colossendeis colossea*
1125	do	40 03	68 56	291	40.0	s., m	*Nymphon strömi*
1154	Oct. 4	39 55 31	70 39	193		s., m	*Nymphon strömi; Pycnogonum crassirostre*
	1887						
1205	Aug. 11	Vineyard Sound		10	72.0	sh., r	*Anoplodactylus lentus*
1208	do	do		10	72.0	s. g., sh	*Anoplodactylus lentus*
1222	Aug. 27	do		12.5	69.0	s., sh	*Anoplodactylus lentus*
		South Carolina					
	1891						
1649	Jan. 16	Calibogue Sound		7			*Anoplodactylus lentus*
1651	do	do		10			*Anoplodactylus lentus*

Rodger, on Whaler *Esquimaux*, 1892 (Rodger, 1893)

	1892					
(1)	Apr. 4	Gulf St. Lawrence, 20 mi. N. by W., St. Paul's Id.	100		r	*Pycnogonum littorale*
(2)	Apr. 17	Str. of Belle Isle, off Norman's Lt.	60		r	*Nymphon grossipes (mixtum), brevitarse; Pseudopallene circularis*
		BAFFIN LAND				
	May 30	20 mi. SE. Reef Coal Hill	30		r	*Boreonymphon robustum*
	June 25	Off Cape McCulloch	80			*Boreonymphon robustum; Nymphon hirtipes; Eurycyde hispida*
		"a few mi. S"	90			*Boreonymphon robustum*
	July 4	10 mi S. W. Cape Wild	200			*Nymphon macronyx*
	July 30	Coutt's Inlet	130		m	*Nymphon elegans, sluiteri*
	Aug. 4	20 mi ESE Erick Pt	60–100		m., g	*Nymphon microrhynchum? [longitarse?]*
	August	Cumberland Bay	20			*Boreonymphon robustum*
	Sept. 9	Exeter Harbor	10		st	*[10 species, 3 "new"]*
	Sept. 17	Eglington Harbor	15		m	*Nymphon microrhynchum [longitarse?]*
	Oct. 24	10 mi. NW. by N., Erick Pt.	150		r	*Boreonymphon robustum; Nymphon hirtipes, macronyx; Eurycyde hispida*

State University of Iowa Bahamas Expedition, 1893

	1893						
56	June 27	24 16	81 22	200			*Pallenopsis forficifer*
62	June 29	Amer. Shoal Lt., 8 mi. NE. by N.		70–80			*Pallenopsis forficifer; Ascorhynchus colei*
64	do	Amer. Shoal Lt., 8 mi. N. by W.		110			*Pentacolossendeis reticulata*
		Bahamas Bank					*Pallenopsis schmitti*
		bet. Bahamas and Cuba					*Nymphon macrum*
	May–June	off Havana		100–200			*?Anoplodactylus maritimus*

APPENDIX TABLE II—Continued

Caudan, 1895 (Caullery, 1896)

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
	1895	° ′ ″	° ′ ″ W.	*Fathoms*	°*F.*		
2	Aug. 20	46 34	6 52	570–700		fn. s	*Colossendeis macerrima*
3	do	46 28	7 00	1,710		co. m	*Paranymphon spinosum*
11	Aug. 24	44 36	4 25	650		m	*Paranymphon spinosum*
13	Aug. 25	44 17	4 38	950		m	*Paranymphon spinosum*
19	Aug. 28	45 18	6 23	400		m	*Pycnogonum littorale*
23	Aug. 30	46 40	6 52	400			*Pycnogonum littorale*

Ingolf, 1895–1896 (Meinert, 1899—with map; as corrected and amended by Stephensen, 1933)

	1895–96				° *C.*		
2		63 04	9 22	262	5.3	gy c	*Nymphon grossipes, megalops (sarsii), strömi, macronyx, Colossendeis angusta*
3		63 35	10 24	272	0.5	gy c	*Nymphon strömi; Boreonymphon robustum; Colossendeis angusta*
4		64 07	11 12	237	2.5	gy c	*Boreonymphon robustum; Nymphon strömi, macronyx, hirtum*
7		63 13	15 41	600	4.5	b. c	*Nymphon macrum, spinosissimum*
9		64 18	27 10	295	5.8	b. c	*Nymphon hirtum?; Cordylochele malleolata*
11		64 34	31 12	1,300	1.6	glob. c	*Colossendeis colossea, macerrima*
15		66 18	25 59	330	−0.75		*Nymphon elegans, hirtum?; Boreonymphon robustum*
18		61 44	30 29	1,135	3.0	glob. c	*Colossendeis colossea*
24		63 06	56 00	1,199	2.4	gy. c	*Callipallene acus*
25		63 30	54 25	582	3.3	gy. c	*Nymphon macrum; Paranymphon spinosum*
27		64 54	55 10	393	3.8	gy. c	*Nymphon groenlandicum, hirtipes, macrum; Cordylochele longicollis*
28		65 14	55 42	420	3.5	gy. c	*Nymphon macrum*
28		65 34	54 31	68	0.2	s	*Nymphon strömi, longitarse*
31		66 35	55 54	88	1.6	s	*Nymphon grossipes*

32		66 35	56 38	318	3.9	gy. c	*Nymphon strömi, leptocheles, spinosissimum, macrum; Cordylochele malleolata, longicollis*
33		67 57	55 30	35	0.8	s	*Nymphon spinosissimum*
35		65 16	55 05	362	3.6	c	*Nymphon strömi, leptocheles, spinosissimum*
36		61 50	56 21	1,435	1.5	c	*Callipallene acus*
38		59 12	51 05	1,870	1.3	glob. c	*Nymphon megalops*
41		61 39	17 10	1,245	2.0	glob. c	*Boreonymphon robustum*
44		61 42	9 36	545	4.8		*Nymphon strömi*
47		61 32	13 40	950	3.23	glob. c	*Pallenopsis longirostris (plumipes).*
51		64 15	14 22	68	7.32		*Nymphon hirtum?*
53		63 15	15 07	795	3.08		*Nymphon hirtum?*
54		63 08	15 40	691	3.9		*Nymphon hirtum?*
55		63 33	15 02	316	5.9		*Nymphon macrum*
64		62 06	19 00	1,041	3.1	b. c	*Colossendeis angusta, clavata*
70		63 09	22 05	134	7.0		*Colossendeis angusta*
73		62 58	23 28	486	5.5	c	*Cordylochele longicollis*
78		60 37	27 52	799	4.5	glob. c	*Nymphon hirtum?*
81		61 44	27 00	485	6.1	glob. c	*Nymphon macrum*
87		65 02	23 56	110			*Nymphon grossipes, strömi, hirtum?*
88		64 58	24 25	76	6.9		*Colossendeis macerrima; Pycnogonum crassirostre*
93		64 24	35 14	767	1.46		*Nymphon serratum, megalops, hirtum?*
94		64 56	36 19	204	4.1	br. sh., s	*Nymphon serratum; Paranymphon spinosum*
95		65 14	30 39	752	2.1		*Nymphon grossipes, hoeki, brevitarse*
96		65 24	29 00	735	1.2		*Nymphon brevitarse*
98		65 38	26 27	138	5.9	s., for	*Nymphon hirtum?*
101		66 23	12 05	537	−0.7	gy. c	*Boreonymphon robustum; Nymphon macronyx*
103		66 23	8 52	579	−0.6	c	*Boreonymphon robustum; Nymphon macronyx; Colossendeis angusta*
104		66 23	7 25	957	−1.1	glob. c	*Colossendeis angusta*
105		65 34	7 31	762	−0.8	glob. c	*Nymphon macronyx, sluiteri; Boreonymphon robustum; Colossendeis angusta*
106		65 34	8 54	447	−0.6	c	*Nymphon strömi; Colossendeis angusta*
110		66 44	11 33	781	−0.8	c	*Colossendeis angusta*
112		67 57	6 44	1,267	−1.1	glob. c	*Ascorhynchus abyssi (tridens)*
113		69 31	7 06	1,309	−1.0	glob. c	*Ascorhynchus abyssi (tridens); Colossendeis angusta*
114		70 36	7 29	773	−1.0		*Ascorhynchus abyssi (tridens)*
115		70 50	8 29	86	0.1	bl. c	*Boreonymphon robustum*
116		70 05	8 26	371	−0.4	c	*Boreonymphon robustum; Nymphon sluiteri, elegans, macronyx; Colossendeis proboscidea*

APPENDIX TABLE II—Continued

Ingolf, 1895–1896—Continued

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
	1895–96	° ′ ″	° ′ ″ W.	*Fathoms*	°*C.*		
117		69 13	8 23	1,003	−1.0	glob. c	*Colossendeis angusta*
120		67 29	11 32	885	−1.0	c	*Colossendeis angusta*
121		66 59	13 11	529	−0.7		*Nymphon grossipes*
124		67 40	15 40	495	−0.6	gy. c	*Colossendeis proboscidea*
125		68 08	16 02	729	−0.8	c	*Colossendeis angusta*
126		67 19	15 52	293	−0.5		*Nymphon elegans; Boreonymphon robustum; Cordylochele malleolata*
127		66 33	20 05	44	5.6	g	*Nymphon hirtum?, serratum; Pseudopallene circularis*
138		63 26	7 56	471	−0.6	g., c	*Nymphon strömi, sluiteri, elegans, macronyx; Boreonymphon robustum; Colossendeis angusta*
139		63 36	7 30	702	−0.6	c	*Boreonymphon robustum; Colossendeis proboscidea*
140		63 29	6 57	780	−0.9	c	*Boreonymphon robustum; Nymphen macronyx; Colossendeis angusta*
141		63 22	6 58	679	−0.6	gy. c	*Boreonymphon robustum; Nymphon macronyx; Colossendeis angusta*
143		62 58	7 09	388	−0.4	gy. c	*Boreonymphon robustum; Nymphon megalops*
144		62 49	7 12	276	1.6		*Nymphon hirtum?*

Hirondelle, 1886–88; *Princesse Alice*, 1891–1915 (Bouvier, 1917)

	1887			*Meters*			
161	Aug. 2	46 04 40	46 42 15	1,267		sft. gy. m	*Nymphon macrum; Colossendeis angusta*
	1888						
184	July 14	40 05	27 27 45	1,850		glob. m	*Colossendeis colossea*
247	Aug. 30	38 24	28 01 25	318		r	*Endeis spinosa*
	1891						
269	Sept. 11	50 05	30 22 45	63			*Nymphon grossipes*

	1892						
273	Aug. 13	50 22	0 00	70			*Pycnogonum littorale*
	1894						
467	July 28	36 31	11 33 45	60			*Achelia echinata*
486	Aug. 21	43 52	9 05 45	1,674		fn. s., for	*Colossendeis macerrima*
503	Aug. 29	47 10	50 47 45	1,262		m., s	*Pycnogonum littorale*
	1895						
515	June 17	38 12	9 37 45	2,028		gy. m	*Colossendeis colossea*
575	July 13	38 27	26 30 15	1,165		m., s	*Colossendeis colossea*
584	July 16	38 31	26 49 15	845		r	*Callipallene producta*
	1896						
683	July 7	38 20	28 04 45	1,550		m., s	*Colossendeis colossea*
	1897						
882	Aug. 7	38 03 40	28 34 45	98		g. s. brk. sh	*Achelia echinata*
	1898						
922	July 6	58 16	5 48 15	343		gn. m	*Nymphon spinosissimum; Cordylochele longicollis*
952	July 22	69 17 30	14 24 15	1,185		m	*Boreonymphon robustum; Colossendeis proboscidea*
960	July 29	72 37	20 00 15	394		g., m	*Boreonymphon robustum; Nymphon hirtipes*
966	July 30	Beeren Id		20			*Nymphon grossipes*
970	July 31	76 30	25 27 15	48		g., sh	*Nymphon grossipes, serratum*
997	Aug. 11	78 22	17 10 15	102		bk. m	*Nymphon hirtipes; Cordylochele brevicollis*
1012	Aug. 18	80 01	10 15 15	430		m., s	*Nymphon strömi, sluiteri, hirtipes, spinosissimum*
1020	Aug. 20/30	78 08 30	13 44 15	393		bk. m	*Nymphon strömi, hirtipes*
1040	Sept. 7	65 21	10 42 15	650		m	*Boreonymphon robustum; Cordylochele brevicollis*
1043	Sept. 13	59 03	1 47 45	88			*Nymphon grossipes*
	1901						
1203	Aug. 18	15 54	22 54 45	91			*Eurycyde raphiaster; Achelia setulosa*
1248	Sept. 13	36 08	8 02 45	1500		gy. m	*Ascorhynchus abyssi*
	1902						
1318	Aug. 5	38 06	26 13 45	3018		m., vol. s	*Colossendeis colossea*
1334	Aug. 13	39 30	29 02 15	1900			*Callipallene acus; Colossendeis colossea*
	1903						
1583	Sept. 15	47 36	7 38	1490		glob. m., vol. s	*Colossendeis colossea*

APPENDIX TABLE II—Continued

Hirondelle, 1886–88; *Princesse Alice*, 1891–1915—Continued

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
		° ′ ″	° ′ ″ W.	*Meters*	°*C.*		
	1906						
2442	July 28	Wijde Bay, Spitsbergen		20			*Nymphon grossipes*
2455	Aug. 2	Pr. Charles Foreland		18			*Nymphon grossipes*
2534	Sept. 5	Karlsö, Norway					*Pseudopallene circularis; Eurycyde hispida*
	1907						
2634	Aug. 7	Havre Grau, Spitsbergen		10–15		m., p	*Nymphon grossipes*
	1908						
2717	July 19	36 42	8 40	750		m., s	*Paranymphon spinosum*
	1910						
2990	Aug. 18	43 45 30	9 41	2320		glob. m	*Colossendeis colossea, macerrima, clavata*
	1911						
3113	Aug. 9	32 34 45	17 05 30	1700		m., s	*Colossendeis colossea*
	1915						
3437	Aug. 26	42 40	62 49 30	1458			*Colossendeis colossea*

Valdivia, 1898 (Möbius, 1902; G. Schott, Valdivia Exp.1:80–81)

	1898		W.				
3				79			*Pycnogonum littorale*
6	Aug. 7	60 40	5 36	650	−0.1	glob. oz	*Colossendeis angusta*
7	do	60 37	5 42	588	0.8	c. s	*Boreonymphon robustum; Nymphon hirtipes, macrum; Cordylochele malleolata*
10	do	59 37	8 50	1,326	5.4	glob. & terr. sed	*Nymphon macronyx; Cordylochele longicollis; Colossendeis angusta*

Bruce, on *Blencathra*, 1898 (Carpenter, Sci. Proc. Roy. Soc. Dublin 9:279–282)

	1898		E.	*Fathoms*			
	June 6	68 52	49 23	20			*Pseudopallene circularis*
	do	70 02	49 10	34			*Nymphon grossipes*
	June 16	70 48	53 09	20			*Nymphon grossipes; Pseudopallene circularis*
	July 8	76 54	36 48	76			*Cordylochele malleolata*
	July 13	76 28	33 06	100			*Boreonymphon robustum; Nymphon macronyx; Colossendeis proboscidea*
	July 15	78 21	27 55	100			*Boreonymphon robustum; Nymphon strömi*

Princeton Arctic Exp., 1899, whaler *Diana* (Ortmann, 1901)

	1899	[NW. Greenland]				
26	Aug. 9	S. of Cape Alexander	27		r	*Nymphon grossipes*
27	Aug. 10	Off Cape Chalon	35		r. & bryoz	*Nymphon grossipes*
39	Aug. 18	Granville Bay	30–40		sh. & m	*Nymphon hirtipes, longitarse; Pseudopallene circularis*
40	do	Granville Bay	20–30		sh., bryoz. m	*Nymphon grossipes, longitarse, serratum; Pseudopallene circularis*
43	Aug. 20	Barden Bay	20–25		glac. m	*Nymphon grossipes*
49	Aug. 24	Olricks Bay, upp. narrows	15–20		st. & kelp	*Nymphon grossipes*
52	Aug. 25	Robertson Bay	5–15		kelp	*Nymphon longitarse*

Swedish Zoological Expedition, 1899–1900 (Lönnberg, 1902, pp. 353–359)

	1899		W.	*Meters*			
18		74 65	17 59	350			*Colossendeis angusta*
24		73 24	21 25	70			*Nymphon hirtipes*
25		72 28	21 48	180			*Boreonymphon robustum*
41		72 43	24 49	35–60			*Nymphon hirtipes*
42		72 56	24 49	125			*Boreonymphon robustum*
43		73 32	24 35	100–110			*Boreonymphon robustum*

APPENDIX TABLE II—Continued

Swedish Zoological Expedition, 1899–1900—Continued

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
	1900	° ′ ″	° ′ ″ W.	*Meters*	°*C.*		
6		Spitsbergen		350		m	*Nymphon hirtipes*
			E.				
7		78 20	11 30	5–10		st., alg	*Nymphon grossipes*
8		Spitsbergen		10–30		st. & s., lam	*Nymphon longitarse*
			W.				
13		72 01	8 33	2,400		m	*Ascorhynchus abyssi*
16		72 25	17 56	300		st. s	*Boreonymphon rubustum; Nymphon elegans, hirtipes*
17		Mackenzie Bay, E. Greenland.		12–35		m	*Boreonymphon robustum; Nymphon hirtipes, strömi, sluiteri; Cordylochele brevicollis*
18		74 30	18 40	80–100		m. & st	*Nymphon hirtipes, grossipes (mixtum), sluiteri; Cordylochele brevicollis*
19		74 35	18 15	150		m	*Boreonymphon robustum; Nymphon hirtipes, strömi*
20		73 55	19 20	150		m	*Boreonymphon robustum; Nymphon grossipes (mixtum), hirtipes, strömi*
21		Mackenzie Bay		250		m	*Boreonymphon robustum; Nymphon hirtipes, elegans, macronyx*
22		do		12–18		m	*Nymphon strömi, macronyx; Colossendeis angusta*
23		do		3–10		m	*Nymphon hirtipes, longimanum*
24		do		1–3		s	*Nymphon sluiteri, macronyx, longimanum*
25		Fr. Josef Fjord		300		m	*Boreonymphon robustum*
26		Fr. Josef Fjord		100		m	*Boreonymphon robustum; Nymphon strömi, macronyx*
27		Fr. Josef Fjord		220			*Boreonymphon robustum; Nymphon strömi, macronyx; Cordylochele brevicollis; Colossendeis proboscidea*
28		Mackenzie Bay		100		m	*Boreonymphon robustum; Nymphon strömi, hirtipes; Colossendeis angusta*
29		72 42	14 49	2,000		m., for	*Ascorhynchus abyssi*

Michael Sars, 1900–14, Stephensen (various papers, amended and corrected by correspondence).[b]

	1900						
58	Aug. 30	72 40	23 10	300	3.2°/300 m.		*Colossendeis proboscidea*
62	Sept. 5	74 19	16 30	280	2.0°/250 m.		*Nymphon strömi?, macrum*
		74 15	16 50				
	1901						
II	May 9	71 22	27 55	393			*Nymphon leptocheles*
	1902		E				
35	June 27	62 58	1 56	1,100		c.	*Boreonymphon robustum; Colossendeis proboscidea*
37	June 29	62 42	1 26	775		c.	*Nymphon elegans*
38	do	62 33	1 56	550	4.91/400 m.	br. s.	*Nymphon hirtipes*
55	July 19	62 40	1 56	670	−0.21	c.	*Boreonymphon robustum; Nymphon elegans; Colossendeis angusta, proboscidea*
56	July 20	62 33	2 03	500	?.90	fne. s.	*Nymphon strömi*
			W				
67	July 28	62 35	4 04	600	−0.13/620	c.	*Nymphon elegans*
75	Aug. 10/11	60 10	6 35	1,220	−0.41/1100	fne. br. bk s.	*Nymphon elegans*
76	Aug. 11/12	59 28	8 01	1,100–1,300	8.07°/1000	c.	*Nymphon spinosissimum, macronyx; Colossendeis proboscidea*
91	Aug. 23	64 27	13 27	ca. 160	4.5 (?)	dk. s., st.	*Nymphon spinosissimum, hirtipes, grossipes, strömi, macrum, serratum*
	1903						
139	June 26	61 33	0 09	164			*Pycnogonum littorale*
			E				
144	July 1	58 0	3 24	93			*Nymphon strömi; Pycnogonum littorale*
	1904						
212	June 19	57 44	5 35	100			*Nymphon strömi*
263	July 1	55 44	1 49	77		dk. s.	*Pycnogonum littorale*
			W				
275	July 6	57 09	1 30	96	6.15		*Nymphon strömi*
			E				
351	Aug. 27	59 34	1 30	110		fne. s.	*Pycnogonum littorale*
	1905						
62		70 03	36 0	160	1.92–2.0		*Colossendeis proboscidea*
72	July 24	74 12	17 18	200–215	1.82–2.0/200 m.		*Colossendeis proboscidea*

APPENDIX TABLE II—Continued

Michael Sars, 1900–14, Stephensen—Continued

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
		° ′ ″	° ′ ″	*Meters*	°*C.*		
	1909		E.				
108		70 32	18 17	300		s.	*Nymphon leptocheles*
	1910		W.				
13	May 22	41 32	9 05	78			*Nymphon macrum*
70	June 30	42 59	51 15	1,100	3.7		*Nymphon macrum*
102	July 10	60 57	4 38	1,098			*Boreonymphon robustum*
	1911						
18c	May 24	62 09	00 02	500/700			*Boreonymphon robustum*
		62 14	00 21				
	1914		E.				
4	June 3	70 11	30 41	115–124	4.2 / 115 m.		*Boreonymphon robustum*
		71 12	30 46				
6	June 4	70 09	30 52	199–209		s. & c.	*Nymphon hirtipes*
		70 10	30 55				
7	June 5	70 18	32 23	206	2.2 / 195 m.	s., sh. st.	*Nymphon serratum*
28	June 24/25	70 16	32 20	158–275	1.9 / 160 m.	s., co., c.	*Nymphon hirtipes*
		70 17	32 27				
56	July 13	75 07	32 22	179		sh., s., g.	*Boreonymphon robustum; Colossendeis proboscidea*
62	July 16	74 15	20 36	166–200	0.64 / 140 m.	c., sh.	*Nymphon hirtipes*
63	do	74 09	19 18	106		s. sh.	*Nymphon hirtipes*
65	July 18	74 15	17 42	170/183	4.99 / 150 m.	s. g.	*Nymphon serratum, leptocheles, Boreonymphon robustum*
		74 21	17 15				
74	July 31	70 40	20 50	168/220	6.17 / 180 m.	s. & c.	*Cordylochele malleolata*
		70 43	20 27				

Miscellaneous (Stephensen, 1935) [b]

	***Heimdal*, 1900**						
14		70	4 31 10	94	2.65		*Nymphon hirtipes*
	***Tovik*, 1924**						
91	Aug. 22	78 2 30	14 12	153			*Nymphon leptocheles*
	***Tovik*, 1925**						
26	July 13	76 50	13 22	148–175	3.8 / 100 m.		*Nymphon hirtipes*
	***Tovik* and *Kirkholmen*, 1928**						
49	Sept. 2	Green Harbor, Svalbard					*Nymphon leptocheles*

Iceland (Stephensen, "Zoology of Iceland," 1937) [c]

			W			
		64 51	13 45	150			*Nymphon hirtipes*
		65 42	13 57	113			*Nymphon serratum*
		65 14	14 08	51			*Nymphon spinosissimum*
		64 25	14 18				*Pseudopallene spinipes*
		64	14 22	128	7.32		*Nymphon spinosissimum*
		64 04	15 42	65			*Nymphon grossipes*
		66 17	18 13	98			*Nymphon hirtipes; Pycnogonum littorale*
		63 27	18 27	150			*Nymphon spinosissimum*
		63 20	20 00	65–75			*Nymphon hirtum*
		63 15	20 04	216			*Nymphon spinosissimum*
		66 33	20 05	83	5.6		*Nymphon hirtipes, grossipes; Pseudopallene circularis*
		63 30	20 14	80			*Nymphon hirtum, grossipes, longitarse, strömi*
		63 18	21 30	178			*Nymphon spinosissimum, grossipes, leptocheles*
		63 15	22 23	216–326			*Nymphon spinosissimum, grossipes, leptocheles, strömi*
		64 04	22 26 30	40			*Nymphon hirtum*
		66 13	23 42	50			*Nymphon hirtum*
		65 02.3	23 56.5	207			*Nymphon spinosissimum, grossipes, strömi*
		65 52	23 58	62			*Nymphon hirtum; Pseudopallene spinipes*
		60	24 09	60	7.2	g. sh	*Pycnogonum crassirostre*
		66	24 14	60			*Nymphon hirtum*
		66 08	24 21	90			*Nymphon hirtipes*
		64 48	24 25	143	6.9		*Pycnogonum crassirostre*
		66 53	24 42	215			*Nymphon hirtipes, grossipes, strömi*
		66 13	25 10				*Nymphon leptocheles*
		66 20	25 12	175			*Nymphon hirtipes, macrum*

APPENDIX TABLE II—Continued

Ireland Fisheries, 1901–03 (Carpenter, 1905)

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
	1901			*Fathoms*			
(1)	Aug. 24	77 mi WNW. Achill Head		382	(Deep pelagic tow)		*Nymphon leptocheles; Pallenopsis tritonis (holti); Anoplodactylus typhlops*
(2)	Sept. 12	50 mi WNW. Cleggan Head		120			*Pycnogonum littorale*
(3)	Sept. 13	50 mi NW. by N. Cleggan Head		100			*Pycnogonum littorale*
	1903						
(4)	July 13	50 mi WNW. Cleggan Head		120			*Pycnogonum littorale*
(5)	Aug. 7	50 mi WNW. Tearaght		306	(Deep pelagic tow)		*Anoplodactylus oculatus*
(6)	Aug. 17	50 mi WNW. Cleggan Head		120	do		*Pycnogonum littorale*

***Belgica*, 1905 (Duc d'Orléans, Croisière Oceanographique . . . . Mer du Grönland, 1905, Brussells: Charles Bulens, 1907)**

		° ′ ″	° ′ ″	*Meters*	° *C.*		
	1905		E.				
4	June 12	79 51	11 37	80		s	*Nymphon grossipes, hirtipes; Pseudopallene circularis; Eurycyde hispida*
11A	July 7	79 52	10 42	310	2.42/300 m.	st	*Nymphon hirtipes, serratum*
			W.				
32	July 24	75 58 75 59	14 08 14 12	300	0.38	c	*Boreonymphon robustum; Nymphon macronyx*
41	July 31	78 09	14 01	78	−1.77	st., sh., c. s	*Nymphon grossipes, hirtipes*
45	Aug. 3	77 31	18 24				*Nymphon strömi, elegans*

Tjalfe, 1908–09 (Stephensen, 1933)

			W.	*Meters*			
	1908						
40c	June 10	63 48	52 23	194			*Nymphon hirtipes, grossipes, strömi*
107	July 9	68 20	54 03	420–525			*Nymphon sluiteri, strömi*
155	July 27	69 46	51 22	475			*Nymphon strömi, serratum*
	1909						
337	May 8	64 05	55 20	1,100			*Nymphon hirtipes*
367	May 19	66 22	57 16	686		s. & st	*Nymphon macrum, spinosissimum*
369	May 20	66 45	56 40	abt. 400			*Nymphon spinosissimum*
397	May 31	66 42	56 12	250			*Nymphon grossipes*
402	June 2	64 40	56 37	720–775			*Nymphon hirtipes*
429	June 8	63 54	53 15	988–1400			*Nymphon spinosissimum, macrum; Cordylochele longicollis*
431	June 9	63 24	53 10	892			*Nymphon spinosissimum, macrum*

Michael Sars, 1910 (Olsen, 1913)

			W.	*Meters*			
	1910						
24	May 6/7	35 34	7 35	1,615			*Colossendeis colossea, macerrima*
25B	May 7/8	35 46	8 16	2,055		glob. oz	*Colossendeis colossea, macerrima*
38	May 20	26 03	14 36	83			*Nymphon longituberculatus*
41	May 23	28 08	13 35	1,365		glob. oz	*Colossendeis michaelsarsi*
70	June 30	42 29	51 15	1,215		r	*Colossendeis angusta*
70	do	42 29	51 15	1,100	(Deep pelagic tow)		*Nymphon macrum; Colossendeis macerrima*
102	Aug. 10	60 57	4 38	1,098		bu. m	*Boreonymphon robustum; Colossendeis angusta*
102	do	60 57	4 38	1,000	(Deep pelagic tow)		*Nymphon grossipes*

Grampus, 1912 [d]

			W.	*Fathoms*	° *C.*		
	1912						
10013	July 24	43 16	70 20				*Nymphon grossipes*
10019	July 29	43 30	69 48	45 (91)	5.67		*Nymphon grossipes, strömi*
10021	Aug. 2	43 38	69 13	60 (110)	7.22		*Nymphon longitarse*
10037	Aug. 21	44 17	68 05	22 (37)	9.89		*Nymphon grossipes, Pseudopallene circularis; Phoxichilidium femoratum*

APPENDIX TABLE II—Continued

***Sylvana*, 1913 (Bouvier, 1914a)**

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
		° ′ ″	° ′ ″ W.	*Meters*	° *C.*		
	1913	[Port. Guinea]					
(1)	Apr. 5	Near Rouban & Bubak Id.		25–30			*Anoplodactylus polignaci*

***Pourquoi Pas?* 1913 (Bouvier, 1914c)**

	1913						
22		70 47	08 22	140			*Boreonymphon robustum; Nymphon hirtipes, longimanum* var. *le danoisi*
25		71 04	07 56	70			*Nymphon hirtipes; Colossendeis proboscidea*
27		70 58	08 07	160			*Boreonymphon robustum; Nymphon hirtipes, strömi*
28		70 58	08 42	40			*Nymphon hirtipes, grossipes*
29		70 56	08 55	40			*Nymphon hirtipes*
30		70 58	08 54	300			*Boreonymphon robustum*
31		66 13	23 42	50			*Nymphon hirtum*
32		66 00	24 14	60			*Nymphon hirtum*

[Remy, 1928. Ann. Sci. Nat. Paris (10), 11; 209-248 (230)]

	1926						
2043	Aug. 11	70 20	21 40	70		bu. m., r.	*Nymphon hirtipes*

Prince, 1917 (Giltay, 1942; station data from A. G. Huntsman, pers. comm.)

	1917						
43	July 16/17	47 06 20	61 26 45	40–45	0.79	s	*Nymphon grossipes (glaciale), longitarse; Achelia scabra*
48	July 30	47 03 45	59 51 58	378	3.90	sft. m	*Pallenopsis longirostris*
30	Aug. 7	46 42 53	61 03 40	87–93			*Nymphon longitarse*
53A	Sept. 1	46 40 48	61 01 47	40			*Nymphon longitarse*
54	Sept. 10	46 41 28	61 02 30	60			*Nymphon longitarse*

Fish Hawk, 1901–20

	1901			*Fathoms*			
7148	Nov. 6	29 48 10	83 55 15	5			*Anoplodactylus insignis*
7201	Dec. 6	29 32 30	85 50 00	9			*Anoplodactylus insignis*
	1902						
7279	Nov. 14	24 21 55	81 58 25	98			*Pentacolossendeis reticulata*
7283	Nov. 19	24 17 30	81 53 30	127			*Nymphon macrum*
7285	do	24 15 00	81 47 30	306			*Pallenopsis forficifer*
7288	Nov. 24	24 42 50	81 53 38	7			*Anoplodactylus insignis*
7293	do	24 42 30	81 55 52	7¼			*Anoplodactylus insignis*
7351	Dec. 17	25 09 45	81 18 35	3¼			*Anoplodactylus insignis*
	1915						
8341	Nov. 22	37 22 12	76 10 25	9.5			*Tanystylum orbiculare*
	1916						
8506	Apr. 22	37 16 50	76 14 27	5.5			*Tanystylum orbiculare*
	1920	[CHESAPEAKE BAY]					
8821	July 8	Off Sandy Point		7.77			*Callipallene brevirostris*
8826	do	Off Plantation Point		45.75			*Anoplodactylus parvus*
8841	Aug. 22	do		12.8			*Endeis spinosa*
8887	Oct. 19	Off Rappahannock Spit		12.81			*Anoplodactylus parvus*
8898	Dec. 4	Off Thimble Rock		28.08			*Callipallene brevirostris*

APPENDIX TABLE II—Continued

***Vanneau*, 1923–26 (Loman, 1925, 1928b, 1929)**

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
		° ′ ″	° ′ ″	*Meters*	° *C.*		
	1923		*W.*				
XXII	July 23	34 05	7 05	130–150		bk. m	*Anoplodactylus massiliensis*
XXI	July 27			140–150			*Achelia echinata*
	1924						
XXXI	May 30	33 54 30	7 34	125		bk. m	*Anoplodactylus massiliensis; Achelia echinata; Endeis spinosa*
XXXIII	June 2	33 41 15	7 35 51	50		fn. s	*Ascorhynchus arenicola*
XLV	June 14	33 37 05	7 56 06	55		s., r	*Endeis spinosa*
LVII	June 24	33 24	8 24 06			s., cal. alg	*Endeis spinosa*
	1925						
LXVIII	July 22	30 34 40 30 34 55	9 48 30 9 48 25	43		m	*Nymphon gruveli*
LXXII	August 25	30 30 25	9 43 30	40			*Nymphon gruveli*
LXXIII	August 26						*Nymphon gruveli*
LXXX	August 31	30 21	9 56 30	150		m., s., r	*Pycnogonum nodulosum*
LXXXII	do	30 21 40	9 41 40	30			*Nymphon gruveli*
LXXXIII	September 2	30 27	9 56 10	150		s. m	*Nymphon gruveli*
LXXXVIII	September 3	30 38 10	9 58 40	80			*Achelia echinata*
XCI	September 5	30 32 50	10 08 50	150		m. s	*Endeis spinosa*
XCVII	September 8	30 30 30	9 47	52		r	*Nymphon cognatum*
	1926						
CXVIII	August 25	30 36	9 52 40	20		s	*Nymphon gruveli; Ascorhynchus arenicola*
CXIX	do	30 36	9 55 10	47		s	*Nymphon gruveli*
CXXI	do	30 37 20	9 54 30	18		r., rd. alg	*Nymphon cognatum*
CXXVIII	August 28	30 27 50	9 50 47	115		s., r	*Endeis spinosa*
	August 29	30 31 30 30 36	9 55 9 51	20–93		m., s	*Nymphon gruveli*

Dana, 1925 (Stephensen, 1933)

	1925						
2338	June 20	64 45	54 06	490			*Nymphon spinosissimum*
2346	June 22	66 37	56 37	460	3.12		*Nymphon spinosissimum; Cordylochele longicollis; Colossendeis angusta*
2361	June 26	68 08	57 30	398	2.47		*Nymphon grossipes, strömi; Cordylochele brevicollis; Colossendeis proboscidea*
2363	June 27	69 30	56 32	202			*Nymphon hirtipes, strömi, serratum*

Johann Hjort, 1927 (Stephensen, 1935)

	1927		E.				
340	June 23	70	33 17	120–125			*Nymphon serratum, leptocheles*

Godthaab, 1928 (Stephensen, 1933)

	1928	W.					
10	June 3	56 56	51 17	3,500	(Deep pelagic tow)		*Pallenopsis calcanea*
14	June 6	55 00	56 34	314	2.8		*Nymphon hirtipes, elegans*
24	June 14	62 19	56 00	2,550	1.9	(pelagic)	*Pallenopsis calcanea*
29B	June 16	62 42		25			*Pseudopallene circularis*
39	July 3	66 51	57 40	680	0.45		*Nymphon spinosissimum, macrum*
51	July 14	69 45 02	58 25	320	1.7		*Nymphon macronyx*
64	July 28	73 12	58 08	850	0.5		*Cordylochele brevicollis; Colossendeis angusta*
65	do	73 30 08	59 36	225	−0.1		*Nymphon grossipes, strömi*
73	July 30	74 52 05	62 12	450	0.7		*Cordylochele brevicollis*
81	August 1	75 35	65 41	490	0.7		*Boreonymphon robustum*
86	August 4	76 36	68 54	180–80	−1.3		*Nymphon hirtipes, grossipes*
87	do	77 05 05	71 13	790	−0.4		*Boreonymphon robustum; Nymphon strömi; Colossendeis angusta, proboscidea*
94	August 6	77 28 05	68 46	875	−0.4		*Boreonymphon robustum*
97	August 8	78 15 05	73 29	290	−1.05		*Nymphon hirtipes, serratum*
99	do	78 14	74 10	672	−0.5		*Boreonymphon robustum; Nymphon sluiteri, elegans, serratum; Colossendeis angusta, proboscidea*
107	August 14	76 25	69 38	165	−1.2		*Nymphon hirtipes, grossipes, strömi*

APPENDIX TABLE II—Continued

Godthaab 1928—Continued

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
	1928	° ′ ″	° ′ ″ W.	*Meters*	° *C.*		
112	August 16	76 34	74 18	580	−0.5		*Boreonymphon robustum; Nymphon hirtipes, strömi, serratum; Colossendeis angusta, proboscidea*
114	do	76 40	76 20	85	−1.1		*Nymphon hirtipes, elegans; Pseudopallene circularis*
116	August 17	76 08	80 53	80	−1.05		*Nymphon hirtipes*
119	do	76 54	81 01	610	−0.6		*Boreonymphon robustum; Nymphon strömi*
131	August 22	74 12	77 00	680	−0.4		*Boreonymphon robustum· Nymphon strömi; Colossendeis angusta, proboscidea*
143	Sept. 5	70 53	54 03	685	1.05		*Cordylochele brevicollis*
160	Sept. 12	68 17	58 14	410	2.55		*Nymphon strömi; Cordylochele brevicollis*
162	Sept. 13	67 48 05	60 48	1,600	−0.4		*Boreonymphon robustum; Cordylochele brevicollis*
166E	Sept. 17	Totness Road, Exeter Sd. [66 19 N]		75–200	−1.6		*Boreonymphon robustum; Nymphon sluiteri*
166c	Sept. 17			abt. 100			*Nymphon hirtipes*
188	Oct. 10	60 22	47 27	120	5.8		*Nymphon hirtipes, serratum*
Capt. R. A. Bartlett, 1926–41; *Effie M. Morrissey* (Hedgpeth, 1943a—with map)							
	1926	[NW. Greenland]		*Fathoms*			
	July 22	Dalrymple Rock					*Nymphon grossipes*
	Aug.	Northumberland Island					*Nymphon grossipes*
[Putnam—Baffin Land—Exp.]							
	1927	Fox Basin					
	Aug. 8	45 mi. E. Cape Dorchester					*Nymphon elegans*
	Aug. 10	66 30	80				*Nymphon grossipes, elegans; Pseudopallene circularis; Eurycyde hispida*
	Aug 12	66 43	80 07	32–37			*Nymphon elegans, megalops; Pseudopallene circularis; Eurycyde hispida*
	Aug. 13	66 46	79 15	34–37			*Nymphon brevitarse, grossipes, serratum; Eurycyde hispida; Colossendeis proboscidea*
	Aug. 24	67 45	79 09	38			*Eurycyde hispida*

	do	Center, Fox Basin		25			*Eurycyde hispida*
	Aug. 24/25	do		25			*Nymphon grossipes, elegans; Pseudopallene circularis*
	Aug. 25	do		25–31			*Pseudopallene circularis*
	Aug. 26	do		25–31			*Nymphon grossipes, elegans; Eurycyde hispida*
	1930	E. Greenland					
	July 2	Clavering Fjord					*Nymphon grossipes*
	Aug. 30	Angsmagsalik					*Nymphon hirtipes*
	1931						
	July 29	74 21	16 30	46–100			*Nymphon hirtipes*
	July 30	74 04	17 58	120			*Nymphon hirtipes*
				[Peary Memorial Exp.]			
	1932	NW. Greenland					
	July 27	Prudhoe Land					*Nymphon grossipes*
	do	76 32	68 45	12			*Nymphon hirtipes*
	Aug. 28	Kerkoliak, Salveland					*Nymphon grossipes*
				[Norcross-Bartlett Exp.]			
	1933						
	Aug. 3	63 10	85 25		(From floating seaweed)		*Nymphon brevitarse*
	Sept. 3	Fury & Hecla Str		30			*Nymphon hirtipes*
	1935						
7	Aug. 3	75 40	78 50	140–210		g	*Nymphon hirtipes, elegans, Pseudopallene spinipes*
8B	do	75 40	78 55	150–200		m	*Nymphon sluiteri*
	Aug. 4	75 40	78 59	68–120		rky	*Nymphon grossipes*
		NE. Greenland					
	1936						
	Aug. 4	Fr. Josef Fjord					*Boreonymphon robustum*

APPENDIX TABLE II—Continued

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
		° ′ ″	° ′ ″ W.	*Meters*	° *C.*		
		NW. Greenland					
	1937						
	July 28	77 45				rky	*Nymphon serratum*
27	Aug. 2	Bet. C. Alexander & C. Chalon.		25–40		rky	*Nymphon grossipes*
29	do	do		25–40		rky	*Nymphon brevitarse, sluiteri, serratum, megalops*
49	Aug. 7	Northumberland Id					*Nymphon grossipes*
	1938	NW. Greenalnd					
76	July 29	76 03	67 30				*Nymphon hirtipes*
124	Aug. 7	77 45	Murchison Sound.				*Boreonymphon robustum; Nymphon hirtipes, grossipes, elegans, serratum*
126	do	77 45	do				*Nymphon grossipes*
127	do	77 45	do				*Nymphon brevitarse, grossipes; Pseudopallene circularis*
134	do	77 43	do				*Nymphon hirtipes*
135	do	77 42	do				*Nymphon megalops; Pseudopallene circularis*
136	Aug. 7	77 42	do				*Eurycyde hispida*
146	Aug. 8	77 38	do				*Nymphon hirtipes, brevitarse, grossipes*
	1939	S. Greenland					
166	Aug. 24	61	62 30			m., p	*Nymphon hirtipes*
175	Aug. 25	61 10		80–90			*Nymphon hirtipes*
196	do	Cape Farewell		60–70			*Nymphon grossipes*
197	do	do		60–70			*Pseudopallene spinipes*
207	do	do		40–100			*Nymphon hirtipes, grossipes*
208	do	do		60–70			*Pseudopallene spinipes*
210	do	do		70			*Pseudopallene circularis*
218	Aug. 28	do		60–70			*Nymphon grossipes*
	1940	NW. Greenland					
25	July 22	Nr. Conical Rock		25–45			*Nymphon hirtipes*
37	do	do		25–60			*Nymphon hirtipes, serratum*

38	July 23	do		25–60			*Nymphon grossipes*
43	do	Wostenholme Id		12			*Nymphon hirtipes*
44	do	do		13–17			*Nymphon grossipes*
46	do	do		13–17			*Nymphon grossipes*
57	do	do		13–25			*Nymphon grossipes*
	1941						
17		Frobisher Bay		about 60			*Nymphon longitarse*

New York Zoological Society, 1929 (tug *Gladisfen*)[f]

	1929				[deep pelagic tow]		
St. 115, Net 157	June 8	Bermuda circle		1,100		pt. oz	*Colossendeis macerrima*
Net 206	June 22	do		600		pt. oz	*Pallenopsis calcanea*

***Loubyrne*, 1930—Hudson Bay Fisheries Expedition (Hedgpeth 1943a)**

	1930						
19	Aug. 15	61 11	90	136		m., st	*Nymphon hirtipes*
31	Aug. 22	56 10	82 21	75	−2.0	g	*Nymphon serratum*

Coll. G. Préfontaine, 1932, in Gulf of St. Lawrence

	1932			*Meters*			
	July	Trois Pistoles, Quebec		200			*Nymphon sluiteri*

APPENDIX TABLE II—Continued

Johnson-Smithsonian Exp., 1933 (station data Bartsch, 1933, with chart)

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type of bottom	Species of pycnogonids
		° ′ ″	° ′ ″ W.	*Fathoms*	° *C.*		
	1933						
16	Nov. 2	18 29 40 18 31 00	66 08 30 66 10 15	38/65			*Endeis spinosa; Pentapycnon geayi*
78	Nov. 25	18 27 30 18 29 42	65 32 36 65 31 15	109/300			*Pallenopsis schmitti*

***Mercator*, 1935 (Giltay, 1937)**

	1935	[Rio De Oro]		*Fathoms*			
(1)	Oct. 31–Nov. 1	S. of Garnet Head		10–17			*Nymphon gruveli*
(2)	Nov. 1	do		17			*Nymphon gruveli*
(3)	Nov. 3	Villa Cisneros		12			*Nymphon gruveli*
		[Senegal]					
(4)	Nov. 13	Dakar Bay					*Nymphon adami*
(5)	Nov. 14	Rufisque		12			*Nymphon adami*

***Président Théodore-Tissier*, 1935–36 (Fage, 1942)**

		° ′ ″	° ′ ″ W.	*Meters*	° *C.*		
	1935						
534	July 4	44 54	3 10	1,680–2,770			*Colossendeis macerrima*
	1936						
698	May 12	14 47	17 33	120–145		m., s.	*Nymphon gruveli*
699	do	14 49	17 35.5	160–235		gn. m.	*Nymphon gruveli, prolatum*
718	May 18	10 50	17 06	120			*Achelia langi*
725	May 21	9 24.5	14 16	38			*Endeis charybdaea*
729	May 25	9 21	14 15	35			*Anoplodactylus polignaci, Endeis charybdaea*
741	May 30	13 14	17 30	100			*Achelia langi*
744	June 1	14 22	17 05	15–25			*Nymphon gruveli, Endeis spinosa*
758	June 10	20 03	17 36	100			*Endeis spinosa, Ascorhynchus similis*
769	June 15	24 00	16 48				*Nymphon mauritanicum*

		Smithsonian-Hartford Exp., 1937					
37	*1937* Apr. 10	St. Croix, Virgin Is. [mangrove roots]					*Anoplodactylus carvalhoi*
		***Atlantis*, 1937–40 (Caribbean data: Chace, 1940, with map)**					
			W.	*Meters*			
24	*1937* Apr. 14	"Gulf, no label."		1,000			*Colossendeis macerrima*
				Fathoms			
(1)	Aug. 11	39 28	71 58	640			*Colossendeis colossea*
(2)	*1938* Aug. 3	37 43	73 40	1,105			*Colossendeis colossea*
(3)	*1939* July 26	40 05	68 05	1,105–35			*Colossendeis angusta, minuta*
2950	*1938* Feb. 3	26 14	78 43	285			*Ascorhynchus armatus*
2981	Mar. 30	22 48	78 48	225			*Ascorhynchus armatus*
3000	Mar. 21	23 10	81 29	170–225			*Ascorhynchus armatus*
3384	*1939* Apr. 26	22 34	78 00	290			*Ascorhynchus armatus*
3388	Apr. 26	22 32 30	78 09	255			*Ascorhynchus armatus*
3391	Apr. 27	22 34	78 14	220			*Ascorhynchus armatus*
3392	do	22 35	78 16	225			*Ascorhynchus armatus*
3460	Apr. 29	22 47	78 14	261			*Ascorhynchus armatus*
3469	May 9	23 12	81 22	425			*Pallenopsis forficifer*
3990	*1940* Aug. 14	38 05	73 40	990			*Colossendeis colossea*
		Allan Hancock Foundation, *Velero III*, 1939					
A 15–39	*1939* Apr. 8	Outside Bahia Honda, Colombia.		8–9		corallines	*Achelia sawayai; Eurycyde raphiaster*
A 32–39	Apr. 15	10 50 30	63 54 30	21–35		s. & sh.	*Achelia sawayai*
		3 miles north of Coche Id., Venezuela.					

Station No.	Date	Lat. N.	Long.	Depth	Temp. at bottom	Type at bottom	Species of pycnogonids
		***Pelican*, 1940**					
169–7	*1940* Jan. 18	28 24.5	80 03.0	45			*Pallenopsis schmitti; Anoplodactylus lentus, insignis, sp.* B
		***Casoar*, 1936, 1938, M. Cadenut, coll. (Fage, 1942)**					
	Feb. 10, 1936	Off Cap Blanc		90–100			*Nymphon mauritanicum*
	October 1938	Off Rio de Oro		90–100			*Nymphon gruveli*

[a] The station numbers given by Bouvier (1937) do not agree with the numbers on Sanderson Smith's list, or, for that matter, with Bouvier's earlier paper (1916b). Inasmuch as the positions and other data given seem to be correct, I have reassigned the older station numbers. An attempt to make the data agree with Bouvier's numbers, on the supposition that he derived his data from reading the wrong lines of the station record, produced some manifest absurdities, such as a record for *Colossendeis angusta* at 96 fathoms with a bottom temperature of 15° C. (station 93) and an abyssal record of 1,999 fathoms for *Achelia echinata* (station 105). Bouvier's numbers are indicated in brackets. Although not so stated, Bouvier's positions are based on the Paris meridian. The longitudes have been converted to Greenwich meridian.

[b] Many of the records in Stephensen's various papers did not include station numbers or dates. These records were later corrected by the late Doctor Stephensen against the original station lists, and I am glad to acknowledge his assistance in correcting this part of the table and supplying additional data not included in his papers.

[c] Compiled from Stephensen's reports on pycnogonids of Norway and Iceland, based partly on collections made by the *Michael Sars*. Sometimes the locations are specifically referred to as *Michael Sars* stations, but usually only the positions are given. All those which include temperature data are certainly *Michael Sars* stations, and the others appear to be. Unfortunately, complete station records have not been published; hence it has been impossible to assign numbers to most of these records. There are several typographical errors; station 756 (1900) does not agree with the published record for the 1900 station of that number, which is 71°05′ N., 26°17′ E. These records have been omitted from the index.

[d] The depths in parentheses are those of the bottom at the stations, as given in H. B. Bigelow's "Physical Oceanography of the Gulf of Maine" (Bull. U. S. Bur. Fish., 1924); those not bracketed are from the labels with the specimens. They may represent tow-net hauls at those depths.

[e] By some unhappy coincidence these particular stations are omitted from Charcot's station lists in the Annales Hydrographiques, 1921.

[f] Collected within the 8-mile circle of intensive observations off Bermuda. The center of this circle is lat. 32°12′ N., long. 64°36′ W. Sample data from the above area include a temperature of 3.54° C. (38.4° F.) at 1,089 fathoms.

APPENDIX TABLE III

PELAGIC RECORDS OF PYCNOGONIDS, FROM SARGASSUM IN MID-ATLANTIC

Gauss, 1901 (Hodgson, 1927)

Station No.	Date	Lat. N.	Long W.	Species of pycnogonids
	1901	"South of Azores"		*Anoplodactylus maritimus*
	Timmerman, 1932—with map			
	1922	° ′	° ′	
1	Nov. 24	36 26	32 19	*Anoplodactylus petiolatus*
2	do	36 22	32 46	*Anoplodactylus petiolatus*
5	Nov. 26	34 25	40 05	*Endeis spinosa*
6	Nov. 27	33 19	43 55	*Anoplodactylus petiolatus; Endeis spinosa*
7	Nov. 28	31 56	48 25	*Anoplodactylus petiolatus*
8	Nov. 29	30 20	53 10	*Anoplodactylus petiolatus*
9	Nov. 30	28 31	56 36	*Anoplodactylus petiolatus*
	1923			
22	Jan. 24	25 10	64 56	*Anoplodactylus petiolatus*
23	Jan. 25	27 09	61 23	*Anoplodactylus petiolatus*
24	Jan. 26	29 26	57 16	*Anoplodactylus petiolatus*
25	Jan. 27	30 50	54 15	*Anoplodactylus petiolatus*
	1922			
41	Oct. 25	41 00	34 00	*Anoplodactylus petiolatus; Endeis spinosa*
42	do	39 30	34 00	*Anoplodactylus petiolatus*
43	do	40 00	40 00	*Anoplodactylus petiolatus*
46	do	29.00	42 00	*Anoplodactylus petiolatus*
47	Oct. 11	27 00	39 00	*Anoplodactylus petiolatus*
	1899			
48	Aug. 3	39 24	57 48	*Anoplodactylus petiolatus*
49	Aug. 2	41 36	56 18	*Anoplodactylus petiolatus*
54		24 00	43–44	*Anoplodactylus petiolatus; Endeis spinosa*
	***Mercator*, 1936 (Giltay, 1937)**			
	1936	° ′	° ′	
	Mar. 30	30 11	71 08	*Endeis spinosa*
	Gulf of Mexico (Sargassum drifting ashore)			
	1945	° ′ ″	° ′ ″	
	Mar. 25	27 50	97 02 30	*Tanystylum orbiculare*
	1946			
	Apr. 16	27 52 30	97 01 45	*Anoplodactylus petiolatus*

INDEX TO SPECIES INCLUDED IN THE TABLES

Achelia armata Bouvier.
Talisman 118
Achelia brevichelifera, new species
Albatross 2212
Fish Hawk 1028
Achelia echinata Hodge
Talisman 113
Princesse Alice 467, 882
Vanneau xxi, xxxi, lxxxviii
Achelia langi (Dohrn)
Président Théodore-Tissier 718, 741
Achelia sawayai Marcus
Albatross 2379–74
Velero III A15–39, A32–39
Achelia scabra Wilson
Prince 43
Achelia setulosa (Loman)
Princesse Alice 1203
Achelia spinosa (Stimpson) Wilson
Speedwell 291
Anoplodactylus carvalhoi Marcus
Smithsonian–Hartford 37
Anoplodactylus insignis (Hoek)
Albatross 2269
Blake 12
Fish Hawk 7148, 7201, 7288, 7293, 7351
Pelican 169–7
Anoplodactylus lentus Wilson
Albatross 2280, 2316, 2354, 2370, 2371, 2372, 2373, 2375, 2391, 2405, 2596
Blake 10
Fish Hawk 775, 786, 1205, 1208, 1222, 1649, 1651
Pelican 169–7
Anoplodactylus maritimus Hodgson
Gauss, 1901.
?University of Iowa, off Habana
Anoplodactylus massiliensis Bouvier
Travailleur VII–6–1881
Vanneau xxii, xxxi
Anoplodactylus oculatus Carpenter
Ireland Fisheries (5)
Anoplodactylus parvus Giltay
Fish Hawk 8826, 8887
Anoplodactylus petiolatus (Krøyer)
Albatross 2307
Timmermann 1, 2, 6, 7, 8, 9, 22, 23, 24, 25, 41, 42, 43, 46, 47, 48, 49, 54
Gulf of Mexico IV, 1946
Anoplodactylus polignaci Bouvier
Bache (1)
Sylvana (1)
Président Théodore-Tissier 729
Anoplodactylus typhlops Sars
Ireland Fisheries (1)
Ascorhynchus abyssi Sars
Norwegian North Atlantic 35, 53, 205, 303, 353
Ingolf 112, 113, 114
Swedish Zoological Expedition 1900: 13, 29
Princesse Alice 1248
Ascorhynchus arenicola (Dohrn)
Vanneau xxxiii, cxviii
Ascorhynchus armatus (Wilson)
Albatross 2074, 2077, 2084, 2205, 2706, 2725, 2731
Blake 308
Talisman 104
Atlantis 2950, 2981, 3000, 3384, 3388, 3391, 3392, 3460
Ascorhynchus colei Hedgpeth
Bache (1)
University of Iowa 62
Ascorhynchus serratum, new species
Albatross 2359
Ascorhynchus similis Fage
Président Théodore-Tissier 758
Boreonymphon robustum (Bell)
Porcupine 52, 55, 59, 61, 64, 65
Norwegian North Atlantic 18, 48, 192, 362, 363
Knight Errant 2, 8
William Barents 1878: 8, 9; 1879: 5, 6, 10
Triton 6, 8, 9, 10
Rodger, V–30, VI–25, VIII, X–24
Ingolf 3, 4, 15, 41, 101, 103, 105, 115, 116, 126, 138, 139, 140, 141, 143
Princesse Alice 952, 960, 1040
Valdivia 7

Boreonymphon robustum (Bell)—Con.
Bruce VII–13, VII–15
Swedish Zoological Expedition 1899: 25, 42, 43; 1900: 16, 17, 19, 20, 21, 25, 26, 27, 28
Michael Sars 1902: 35, 55; 1911: 18C; 1914: 4, 56, 65
Belgica 32
Michael Sars 1910: 70, 102
Pourquoi Pas? 22, 27, 30
Godthaab 81, 87, 94, 99, 112, 119, 131, 162, 166E
Bartlett VIII–4–1936, 124 (1938)

Callipallene acus (Meinert)
Albatross 2078, 2571
Ingolf 24, 36
Princesse Alice 1334

Callipallene brevirostris (Johnston)
Fish Hawk 824, 928, 8821, 8898

Callipallene producta, (Sars)
Princesse Alice 584

Colossendeis angusta Sars
Albatross 2041, 2042, 2043, 2050, 2057, 2074, 2076, 2093, 2102, 2103, 2105, 2106, 2111, 2115, 2173, 2193, 2195, 2196, 2205, 2209, 2210, 2211, 2217, 2221, 2222, 2231, 2232, 2430, 2469, 2470, 2471, 2534, 2535, 2550, 2562, 2563, 2564, 2571, 2572, 2573, 2575, 2682, 2684, 2706, 2710, 2711, 2725, 2731, 2732 2748
Norwegian North Atlantic 31, 137, 312
Blake 305, 308, 338
Triton 6, 8
Talisman 33, 81, 83, 85, 96, 98
Ingolf 2, 3, 64, 70, 103, 104, 105, 106, 110, 113, 117, 120, 125, 138, 140, 141
Hirondelle 161
Valdivia 6, 10
Swedish Zoological Expedition 1899:18; 1900: 28
Michael Sars 1902: 55
Michael Sars 1910: 70, 102
Dana 2346
Godthaab 64, 87, 99, 112, 131
Atlantis (3)

Colossendeis clavata Meinert
Albatross 2034, 2051, 2072, 2075, 2076, 2196, 2205, 2207, 2209, 2210
Ingolf 64
Princesse Alice 2990

Colossendeis colossea Wilson
Albatross 2050, 2051, 2052, 2072, 2077, 2078, 2094, 2103, 2110, 2111, 2115, 2192, 2193, 2195, 2196, 2205, 2209, 2210, 2217, 2220, 2230, 2231, 2530, 2532, 2533, 2550, 2681, 2683, 2684, 2710, 2725, 2727, 2728, 2731, 2734, 2739
Blake 162, 222, 227, 305, 306, 339, 342
Talisman 16, 42, 46, 52, 53, 76, 147
Fish Hawk 1123
Ingolf 11, 18
Hirondelle 184
Princesse Alice 515, 575, 683, 1318, 1334, 1583, 2990, 3113, 3437
Michael Sars 1910: 24, 25B
Atlantis (1), (2), 3990

Colossendeis macerrima Wilson
Albatross 2072, 2083, 2093, 2115, 2205, 2530, 2533, 2589, 2678, 2725, 2734
Atlantis 24
Blake 338
Travailleur 38
Talisman 41, 45, 81, 83, 85, 103. (*gigas-leptorhynchus:* 146, 149.)
Caudan 2
Fish Hawk 1096
Ingolf 11, 88
Princesse Alice 486, 2990
Michael Sars 1910: 24, 25B, 70
New York Zool. Soc., 115
Président Théodore-Tissier 534

Colossendeis michaelsarsi Olsen
Albatross 2072
Talisman 34
Michael Sars 1910: 41

Colossendeis minuta Hoek
Albatross 2093, 2728, 2734, 2735
Challenger 50
Atlantis (3)
Colossendeis proboscidea (Sabine)
Norwegian North Atlantic 18
Knight Errant 8
Triton 9
William Barents 1878: 8, 10, 11; 1879: 6
Ingolf 116, 124, 139
Bruce VII–13
Swedish Zoological Expedition 1900: 27
Princesse Alice 952
Pourquoi Pas? 25
Michael Sars 1900: 58; 1902: 35, 55, 76; 1905: 62, 72; 1914: 56.
Dana 2361
Godthaab 87, 99, 112, 131
Bartlett VIII–13–1927
Cordylochele brevicollis Sars
Swedish Zoological Expedition 1900: 17, 18, 27
Princesse Alice 997, 1040
Dana 2361
Godthaab 64, 73, 143, 160, 162
Cordylochele longicollis Sars
Albatross 2666, 2667
Ingolf 27, 32, 73
Princesse Alice 922
Valdivia 10
Tjalfe 429
Dana 2361
Cordylochele malleolata (Sars)
Albatross 2428, 2429, 2471, 2528
Porcupine 64, 74
Norwegian North Atlantic 290, 362, 363
Triton 10
Ingolf 9, 32, 126
Bruce VII–8
Valdivia 7
Michael Sars 1914: 74
Endeis charybdaea (Dohrn)
Président Théodore-Tissier 725, 729
Endeis charybdaea bispinata Bouvier
Talisman 120.
Endeis spinosa (Montagu)
Hirondelle 247
Fish Hawk 8841
Endeis spinosa (Montagu)—Continued
Vanneau xxxi, xlv, lvii, xci, cxxviii
Johnson-Smithsonian 16
Timmermann 5, 6, 41, 54
Mercator III–30–1936
Président Théodore-Tissier 744, 758
Ephyrogymna circularis Hedgpeth
Blake 201
Eurycyde hispida (Krøyer)
Norwegian North Atlantic 290
Rodger VI–25, X–24
Princesse Alice 2534
Belgica 4
Bartlett VIII–10–1927, VIII–12–1927, VIII–13–1927, VIII–24–1927, VIII–26–1927, 136 (1938)
Eurycyde raphiaster Loman
Princesse Alice 1203
Velero III A 15–39
Heterofragilia fimbriata Hedgpeth
Blake 204
Nymphon adami Giltay
Mercator (4), (5)
Nymphon brevitarse Krøyer
Rodger (2)
Ingolf 95, 96
Bartlett VIII–13–1927, VIII–3–1933, 29 (1937), 127 (1938), 146 (1938)
Nymphon cognatum Loman
Vanneau xcvii, cxxi
Nymphon elegans Hansen
Porcupine 55
Norwegian North Atlantic 18, 31, 48, 124, 164, 262, 275, 312, 315, 343, 363
Rodger VII–30
Ingolf 15, 116, 126, 138
Swedish Zoological Expedition 1900: 16, 21
Michael Sars 1902: 37, 55, 67, 75
Belgica 45
Godthaab 14, 99, 114
Bartlett VIII–8–1927, VIII–10–1927, VIII–12–1927, VIII–24/25–1927, VIII–26–1927, 7 (1935), 124 (1938)
Nymphon floridanum, new species
Albatross 2405

Nymphon groenlandicum Meinert (=*leptocheles* Sars ?)
Ingolf 27
Nymphon grossipes (O. Fabr.) Krøyer
Albatross 2062, 2260, 2521, 2525, 2694, 2696, 2699
Challenger 49
Valorous 4
Norwegian North Atlantic 31, 223, 273, 290
William Barents 1878: 3, 14; 1879: 13
Speedwell 4, 7, 8, 9, 10, 22, 23, 30, 33, 37, 53, 59, 62, 63, 68, 78, 85, 86, 95, 118, 121, 124, 133, 135, 149, 156, 182, 184, 187, 189, 197, 219, 226, 227, 229, 234, 258, 277, 291, 329, 370, 371, 378
Blake 306
Rodger (2)
Knight Errant 8
Triton 6, 9, 10
Princeton 26, 27, 40, 43, 49
Ingolf 2, 31, 87, 95, 121
Swedish Zool. Exp. 1900: 7, 18, 20
Princess Alice 269, 966, 970, 1043, 2442, 2455, 2634
Michael Sars 1900: 10; 1902: 34, 74, 85, 90
Belgica 4, 41
Tjalfe 40c, 397
Michael Sars 1902: 91; 1910: 102
Grampus 10013, 10019, 10037
Pourquoi Pas? 28
Prince 43
Dana 2361
Godthaab 65, 86, 107
Bartlett VII–22–1926, VIII, VIII–10–1927, VIII–13–1927, VIII–24/25–1927, VIII–26–1927, VII–2–1930, VII–27–1932, VIII–28–1932, VIII–4–1935, 27 (1937), 49 (1937), 124 (1938), 126 (1938), 127 (1938), 146 (1938), 196 (1939), 207 1939), 218 (1939), 38 (1940), 44 (1940), 46 (1940), 57 (1940)
Nymphon gruveli Bouvier
Vanneau lxviii, lxxii, lxxiii, lxxxii, lxxxiii, cxviii, cxix, cxxviii, VIII–29–1936
Mercator (1), (2), (3)
Président Théodore-Tissier 698, 699, 744
Casoar Oct. 1938
Nymphon hirtipes Bell
Albatross 2430, 2471, 2508
Porcupine 64, 65, 78, 88
Valorous 1
Norwegian North Atlantic 48, 223, 262, 267, 270, 273, 275, 290, 326, 336, 338, 363
Speedwell 80, 81, 101, 102, 110, 112, 113, 118
William Barents 1878: 6, 8, 9, 13; 1879; 5, 7, 8, 10, 12, 13
Triton 5
Ingolf 27
Rodger VI–25, X–24
Princeton 39
Valdivia 7
Swedish Zoological Expedition 1899: 24, 41; 1900: 6, 16, 17, 18, 19, 20, 21, 23, 28
Princess Alice 960, 997, 1012, 1020
Michael Sars 1902: 38, 91; 1914: 6, 28, 62, 63
Miscellaneous (Stephenson), Heimdal, 1900: 14; Jovik, 1925: 26
Belgica 4, 11A, 41
Tjalfe 40c, 337, 402
Pourquoi Pas? 22, 25, 27, 28, 29, 2043
Dana 2363.
Godthaab 14, 86, 97, 107, 112, 114, 116, 166c, 188
Bartlett VIII–30–1930, VII–29–1931, VII–30–1931, VIII–27–1932, IX–3–1933, 7 (1935), 76 (1938), 124, 134 (1938), 146 (1938), 166 (1939), 175 (1939), 207 (1939), 25 (1940), 37 (1940), 43 (1940)
Loubyrne 19

Nymphon hirtum (O. Fabr.?) Krøyer
Ingolf 4, 9, 15, 51, 53, 54, 78, 87, 93, 98, 127, 144
Pourquoi Pas? 31, 32
Nymphon hoeki Meinert
Ingolf 95
Nymphon leptocheles Sars
Porcupine 47
Norwegian North Atlantic 290
Ingolf, 32, 35
Ireland Fisheries (1)
Michael Sars 1901, II; 1909: 108; 1914: 65
Miscellaneous (Stephenson), Jovik 1914: 91; Tovik and Kirkholmen 1928: 49
Johann Hjort, 340
Nymphon longimanum Sars
Swedish Zoological Expedition 1900: 23, 24
Pourquoi Pas? 22 (var. *le danoisi*)
Nymphon longitarse Krøyer
Albatross 2212, 2696
Norwegian North Atlantic 336
Speedwell 7, 19, 23, 24, 28, 30, 31, 32, 35, 43, 47, 48, 62, 64, 65, 68, 78, 85, 86, 113, 124, 127, 140, 154, 155, 156, 158, 161, 163, 164, 182, 184, 210, 216, 219, 234, 237, 326
William Barents 1879: 13, 14
Triton 11
Fish Hawk 965
Ingolf 28
Rodger VIII–4, IX–17 (id. as *microrhynchum*)
Prince 30, 43, 53A, 54
Princeton 39, 40, 52
Swedish Zoological Expedition 1900: 8
Grampus 10021
Bartlett 17 (1941)
Nymphon longituberculatus Olsen (=*cognatum* Loman?)
Michael Sars 38
Nymphon macronyx (Sars)
Norwegian North Atlantic 18, 124, 137, 190, 192, 262, 286, 290, 343, 362
Knight Errant 8
Triton 6, 8, 9, 10
Ingolf 2, 4, 101, 103, 105, 116, 138, 140, 141
Nymphon macronyx (Sars)—Continued
Rodger VII–4, X–24
Valdivia 10
Bruce VII–13
Swedish Zoological Expedition 1900: 21, 22, 24, 26, 27
Michael Sars (b)
Belgica 32
Godthaab 51
Nymphon macrum Wilson
Albatross 2067, 2069, 2071, 2115, 2116, 2429, 2471
Challenger 49
Norwegian North Atlantic 290
Speedwell 38, 170, 172, 187, 188, 217
Triton 10, 11
Ingolf, 7, 25, 27, 28, 32, 55, 81
Hirondelle 161
University of Iowa between Bahamas and Cuba
Valdivia 7
Tjalfe 367, 429, 431
Michael Sars 1900: 62; 1902: 91; 1910: 13, 70, 102
Fish Hawk 7283
Godthaab 39
Nymphon mauritanicum Fage
Président Théodore-Tissier 769
Casoar Feb. 10, 1936
Nymphon megalops Sars
Norwegian North Atlantic 31, 48, 200, 343
Ingolf 2, 38, 93, 143
Bartlett VIII–12–1927, 29 (1937), 135 (1938)
Nymphon microrhynchum Sars
Rodger VIII–4, IX–17 (probably *longitarse*)
Nymphon prolatum Fage
Président Théodore-Tissier 699
Nymphon serratum Sars
Valorous 1
Norwegian North Atlantic 315, 338
William Barents 1878: 9
Princeton 40
Ingolf 93, 94, 127
Michael Sars 1902: 91; 1914: 7, 65
Tjalfe 155
Princesse Alice 970
Belgica 11A
Dana 2363

Nymphon serratum Sars—Continued
Johann Hjort 340
Godthaab 97, 99, 112, 188
Bartlett VIII–13–1927, VII–28–1937, 29 (1937), 124 (1938), 37 (1940)
Loubyrne 31
Nymphon sluiteri Hoek
Norwegian North Atlantic 290
William Barents 1878: 9
Ingolf 105, 116, 138
Rodger VII–30
Swedish Zoological Expedition 1900: 17, 18, 24
Princesse Alice 1012
Tjalfe 107
Godthaab 99, 166E
Bartlett 8B (1935); 29 (1937)
Préfontaine, 1932
Nymphon spinosissimum (Norman)
Albatross 2429, 2471, 2484, 2486
Porcupine 78, 88
Ingolf 7, 32, 33, 35
Princesse Alice 922, 1012
Michael Sars 1902: 76, 91
Dana 2338, 2346
Tjalfe 367, 369, 429, 431
Godthaab 39
Nymphon stenocheir Norman
Porcupine 64
Nymphon strömi Krøyer
Albatross 2046, 2062, 2064, 2246, 2415, 2429, 2508, 2517, 2518, 2522, 2523, 2666, 2667, 2669, 2687, 2698, 2703
Porcupine 66
Whiteaves 1871
Norwegian North Atlantic 362, 363
William Barents 1878: 8, 9, 11; 1879: 8
Speedwell 21, 23, 30, 32, 33, 47, 54, 115, 127, 152, 156, 161, 164, 170, 171, 184, 191, 192, 210, 211, 213, 214, 216, 233, 234, 264, 326, 364, 365
Blake 306, 310
Knight Errant 5, 7, 8
Triton 6, 8, 9
Fish Hawk 945, 1121, 1122, 1125, 1154
Nymphon strömi Krøyer—Continued
Ingolf 2, 3, 4, 28, 32, 35, 44, 87, 106, 138
Bruce VII–15
Swedish Zoological Expedition 1900: 17, 19, 20, 22, 26, 27, 28
Michael Sars 1900: 62; 1902: 56, 91; 1903: 144; 1904: 212, 275
Princesse Alice 1012, 1020
Belgica 45
Tjalfe 40c, 107, 155
Grampus 10019
Pourquoi Pas? 27
Dana 2361, 2363, VI–26–1925
Godthaab 65, 87, 107, 112, 119, 131, 160
Nymphon tenellum (Sars)
Albatross 2072, 2111, 2471, 2528
Porcupine 51
Blake 338
Pallenopsis calcanea Stephensen
Godthaab 10, 24
New York Zool. Soc., Net 206
Pallenopsis forficifer Wilson
Albatross 2666, 2667, 2668, 2669
Bache (2)
Blake 260, 264, 317, 318
Fish Hawk 7285
University of Iowa 56, 62
Atlantis 3469
Pallenopsis longirostris Wilson
Albatross 2046, 2470, 2554, 2628, 2699, 2734
Fish Hawk 891
Ingolf 47
Prince 48
Pallenopsis oscitans (Hoek) (=*longirostris*)
Challenger 70
Pallenopsis schmitti Hedgpeth
Albatross 2138, 2143, 2641
Blake 10
University of Iowa, Bahamas Bank
Johnson-Smithsonian 78
Pelican 169–7
Pallenopsis tritonis Hoek
Triton 10
Ireland Fisheries (1)

Paranymphon spinosum Caullery
Albatross 2203, 2214, 2547, 2680
Porcupine 17
Fish Hawk 894, 1093
Caudan 3, 11, 13
Ingolf 25, 94
Princesse Alice 2717
Pentacolossendeis reticulata Hedgpeth
Bache (3)
Fish Hawk 7279
University of Iowa 64
Pentapycnon geayi Bouvier
Johnson-Smithsonian 16
Phoxichilidium femoratum (Rathke)
Speedwell 49, 169
Grampus 10037
Pseudopallene circularis (Goodsir)
Valorous 1
Ingolf 127
Rodger (2)
Princesse Alice 2534
Bruce VI–6, VI–16
Princeton 39, 40
Belgica 4
Grampus 10037
Godthaab 29b, 114
Bartlett VIII–10–1927, VIII–12–1927, VIII–24/25–1927, VIII–25–1927, 127 (1938), 135 (1938), 210 (1939)
Pseudopallene spinipes (Fabr.)
Bartlett 1935: 7; 1939: 197, 208
Pycnogonum crassirostre Sars
Albatross 2183, 2185
Fish Hawk 945, 1154
Ingolf 88
Pycnogonum littorale (Ström)
Albtross 2055, 2062–63, 2183, 2649, 2470, 2506, 2514, 2523, 2526, 2578
Porcupine 45
Whiteaves 1871
Speedwell 29, 32, 41, 42, 48, 187, 188, 229, 264, 326, 364
Blake 302, 303, 304, 305
Knight Errant 3
Rodger (1)
Caudan 19, 23
Valdivia 3
Michael Sars 1903: 139, 144; 1904: 263, 351
Princesse Alice 273, 503
Ireland Fisheries (2), (3), (4), (6)
Pycnogonum nodulosum Dohrn
Vanneau lxxx
Tanystylum orbiculare Wilson
Speedwell 8
Fish Hawk 928, 933, 934, 1041, 8341, 8506
Gulf of Mexico III, 1945